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March 15, 1975

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Volume 31, Number 5, March 15, 1975

NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USERDA Office of Public Affairs
Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

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A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

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All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

CARTER, G., See REED, D.J., 30:21824
CASA, A.F., Nuclear energy in Japan, 30:23243
CASARETT, A.P., See KALLFELZ, F.A., 30:21411
CASCI, C., Method for preliminary analysis of MHD generator performance, 30:20916 (AGARD-CP-104)

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

REACTOR CONTROL SYSTEMS/PERFORMANCE
Optimization of control-rod programming in multiregion nuclear reactors, 30:23184
REACTOR COOLING SYSTEMS/TRANSIENTS
WFLASH: a FORTRAN-IV computer program for simulation of transients in a multi-loop PWR, 30:23171 (WCAP-8261(Rev.1))
REACTOR CORES/INSPECTION
Initial results of a holographic tomosynthesis technique for fuel-core inspection, 30:23198
REACTOR CORES/STRESS ANALYSIS
Methods of stress analysis in use at General Atomic for core design (HTGR graphite moderator), 30:23078 (GA-A-12870)

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

23214 (HEDL-TME-74-16) ANALYSIS OF TEMPERATURE PROFILES IN TRANSIENTLY HEATED UO_2 USING MOLYBDENUM INCLUSIONS. Wilmot, E. L. **(Hanford Engineering Development Lab., Richland, Wash. (USA)).** [nd]. Contract AT(45-1)-2170. 23p. AT.

is indexed as:

HANFORD ENGINEERING DEVELOPMENT LAB., RICHLAND, WASH. (USA)
Analysis of temperature profiles in transiently heated UO_2 using molybdenum inclusions, 30:23214 (HEDL-TME-74-16)
HEDL quarterly technical report, January--March 1974. Volume I. Materials technology, 30:21815 (HEDL-TME-74-1(Vol.1))
Modeling of the post-irradiation fuel-cladding gap in mixed-oxide fuels, 30:23103 (HEDL-TME-74-19)
Preliminary data report: post-irradiation examination of fuel pins PNL-10-23 and PNL-10-63, 30:23149 (HEDL-TME-74-23)
Prototype applications loop two years of operation, 30:20928 (HEDL-TME-74-24)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

SU-IPR-518	30:22074	See N-74-15472
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AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

10491 (AECL-4843) CHEMISTRY AND MATERIALS DIVISION PROGRESS REPORT, APRIL 1, 1974–JUNE 30, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1974. 122p. Dep. NTIS (US Sales Only) $9.25. AECL $3.00.

Research is reported in the areas of solid state science, general chemistry, physical chemistry, and materials science. Lists of publications reporting this work are included. (MCG)

Analytical and Separations Chemistry

Refer also to abstracts 10783, 11308, 11960–11963, 12145, and 13481.

10492 (COM-74-11358) STANDARD REFERENCE MATERIALS: URANIUM ISOTOPIC STANDARD REFERENCE MATERIALS (CERTIFICATION OF URANIUM ISOTOPIC STANDARD REFERENCE MATERIALS). Special Pub. (Final). Garner, E. L.; Machlan, L. A.; Shields, W. R. (National Bureau of Standards, Washington, D. C. (USA)). Apr 1971. 161p. (NBS-SP-260-27). NTIS $11.25.

10493 (ICP-1056) ANALYTICAL CHEMISTRY BRANCH ANNUAL REPORT, FISCAL YEAR 1974. Shank, R. C. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs–Operations Office). Oct 1974. Contract AT(10-1)-1375. 211p. Dep. NTIS $7.60.

The Analytical Chemistry Branch Annual Report presents the non-routine, significant analytical services and supporting development work for FY-1974. The analytical and technical support activities for the Idaho Chemical Programs and other NRTS and outside contractors include mass spectrometry, gas chromatography, atomic absorption spectrophotometry, emission spectrography, x-ray diffractometry, radiochemistry, spectrophotometry, titrimetry, gravimetry, coulometry, quality control, and remote techniques. Improvement of equipment, analytical techniques, and methods are a significant part of this report. Twenty-five items were indexed separately. (auth)

For references to individual sections see: 10505, 10533–10547, 10565–10570, 10782, 11322, 11323, and 11760.

10494 (UCID-15644-74-3) GENERAL CHEMISTRY DIVISION QUARTERLY REPORT, JULY–SEPTEMBER 1974. Harrar, J. E. (comp. and ed.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1974. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

Progress is reported in the following studies: determination of ionic chloride in TATB; faster method of determining isocyanates; analysis of explosive composites; applications of ion-selective electrodes; measurement of HF produced by LX-09 explosive; new universal detectors for gas chromatography; gas chromotograph–microwave spectrometer system; laser Stark spectroscopy; upgrading of the gas analytical mass spectrometer; simulation modeling of a mixed-oxide fuel-rod fabrication plant; effects of particles in geothermal brines; separators for electrolysis cells made from fluoropolymer ion-exchange membranes, and modification of the Auger electron spectrometer. (LK)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 11273, 11414, 12148, 12823, and 13264.

10495 (AERE-R-7823) HIGH RESOLUTION γ SPECTRA OF 40 TO 44 MeV γ PHOTON ACTIVATION PRODUCTS. Part 1. The Elements Sodium to Molybdenum. Anderson, P.; Hislop, J. S.; Williams, D. R. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Sep 1974. 106p. Dep. NTIS (US Sales Only) $8.50. UK £2.00.

Elements of atomic number 11 through 42 with the exception of phosphorus, sulfur and the inert gases were irradiated with 40–44 MeV (E_{max}) bremsstrahlung. High-resolution γ spectra are given for a range of decay times for each element and show the energy and relative intensity of the γ rays observed. Data sheets are also given which identify the nuclides produced by each element, along with the specific activities of selected γ rays. Tables presented enable the extent of possible internuclide interferences in multi-element nondestructive γ photon activation to be assessed. (auth)

10496 (BNWL-SA-5179) BODY COMPOSITION DETERMINATION BY MEASUREMENT OF TOTAL BODY ACTIVATION PRODUCTS IN EXPIRED AIR. Palmer, H. E.; Lewellen, T. K.; Chesnut, C. H. III; Nelp, W. B. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 14p. (CONF-741040-13). Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

In vivo neutron activation followed by whole-body counting has become a routine method for measuring the major elements in the body such as total body calcium. More recently a careful analysis of radioactive components in expired air after neutron activation has shown some of these components are directly related to the body composition of major elements. The activation products are produced both by direct fast neutron reactions and by secondary proton reactions. The protons are produced by hydrogen atom recoil after neutron interaction with the large quantity of hydrogen in the body. The specific longer-lived radionuclides which are easily measured in expired air are ^{37}Ar, ^{41}Ar, ^{11}C, and ^{13}N. The ^{37}Ar is expired as noble gas and is produced by the reaction $^{40}Ca(n,\alpha)^{37}Ar$. The accurate determination of total body calcium in animals has been demonstrated using ^{37}Ar measurements and the determination in humans appears very feasible. The ^{11}C, expired as ^{11}CO and $^{11}CO_2$, is produced by $^{14}N(p,\alpha)^{11}C$ and it appears that total body nitrogen can be determined from the ^{11}C measurements. The usefulness of ^{41}Ar and ^{13}N in the expired air have not yet been determined. The ^{14}MeV neutron generator has been the most useful and adequate source of neutrons for these studies. An increase in the neutron emission rate from these generators would improve their usefulness in these types of studies. (auth)

10497 (CONF-741002-P2, pp 602-611) PREPARATION AND NEUTRON ACTIVATION ANALYSIS OF HIGH PURITY CERIUM. Revel, G.; Rouchaud, J. C.; Pastol, J. L. (Centre d'Etudes de Chimie Metallurgique, Vitry-sur-Seine, France). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

For future research on the structural and electrical properties of cerium, a zone-melting purification method is studied. The container is chosen in a water-cooled copper and treatments are performed in vacuum. Under these conditions, external contaminations of melted cerium are very limited. The influence of zone melting velocity and of passes number are studied. The conditions of the final treatment are defined in function of effective distribution coefficients of principal impurities to be eliminated. Purifica-

tion progress is followed by an original method of neutron activation analysis. This method allows the determination of twenty elements in a range of concentration from 10^{-3} to 10^{-9} g. Obtained results show the efficiency of this zone melting method for the removing of metallic impurities. For example, iron concentration is less than 0.07 μg/g in purified cerium. (auth)

10498 (EUR-5075) PROBLEMS OF THE CONTAMINATION OF MAN AND HIS ENVIRONMENT BY MERCURY AND CADMIUM. Proceedings of International Symposium, Luxembourg, 3–5 July 1973. (Commission of the European Communities, Luxembourg). 1973. vp. (In Several Languages). (CONF-730743-). EUR 1500 FB.

Separate abstracts were prepared for 5 of the 38 papers presented in these proceedings. The other papers discuss the presence of mercury and cadmium in the environment, analytical techniques, ecological consequences, transfer to man, and effects on man. The proceedings also include a round table discussion and extensive concluding remarks on the subject in general. (ERB)

For abstracts of individual papers see: 10499–10502 and 10564.

10499 (EUR-5075, pp 47-67) ECOLOGICAL RESEARCH ON MERCURY IN THE REGION OF MONTE AMIATA (TUSCANY, ITALY). Bombace, M. A. (CNEN-CSN, Rome); Cigna Rossi, L.; Clemente, G. F.; Zucca Labellarte, G.; Allegrini, M.; Lanzola, E. 1973. (In French).

From European colloquium on the problems posed by the contamination of man and his environment by mercury and cadmium; Luxembourg (3 Jul 1973).

The region of Monte Amiata was chosen because it has a large number of mercury mines and metallurgical processing plants. The emphasis of the study was on the detection of the presence of mercury and also its diffusion and concentration in the environment. This included both mercury originating from the earth itself and mercury derived from mining operations. The research methods used were those that have long been applied in radioecology studies. With these methods it is possible, for instance, to define zones that are critical from the point of view of the concentration of the metal. Once these zones had been defined, detailed studies were then carried out within them. In view of the geographical position of the mines in relation to the three largest bodies of water in the region, the latter were surveyed in order to collect a large number of samples of surface water, sediments, and plants, as well as the foodstuffs produced within the zone. Several cooked diets were also monitored, representing the quantity of food consumed in the course of a day in several households. Finally, samples of human hair and air were taken. Two methods of analysis were used in parallel for determining the concentration of mercury. The first was nondestructive neutron activation followed by measurement of the ^{203}Hg gamma emission at 279 keV with the aid of a Ge(Li) detector connected to a ND 50/50 spectrometric system incorporating a small computer for spectrum compilation. The second method used was non-flame atomic absorption. In order to determine the individual levels of consumption and, ultimately, the quantity of mercury ingested by man, an individual pilot food study was carried out for a week. The daily ingestion of mercury was thus calculated both in the cooked diet and in foodstuffs sampled and monitored in the raw state. The households studied were selected on the basis of the position and influence of the mines as indicated by the results obtained beforehand by sampling. (auth)

10500 (EUR-5075, pp 135-148) MERCURY AND CADMIUM IN BELGIAN AEROSOLS. Heindryckx, R.; Demuynck, M.; Dams, R.; Janssens, M.; Rahn, K. A. (Rijksuniversiteit, Ghent). 1973.

From European colloquium on the problems posed by the contamination of man and his environment by mercury and cadmium; Luxembourg (3 Jul 1973).

The chemical composition of the atmospheric aerosol has been studied in various residential and industrial locations in Belgium and at two remote places in Europe. Several small-scale surveys have been performed and a nationwide study is in progress. After collection of airborne particulate matter by filtration on cellulose filters, the samples were submitted to instrumental neutron activation analysis, yielding, among others, mercury and cadmium concentrations. Cadmium was also determined by flameless atomic absorption spectrophotometry. Comparison of concentrations and aerosol-rock enrichment factors in the Ghent industrial area to those measured at remote locations showed important pollution contributions for both elements. The concentrations measured on two different days at 14 stations of the nationwide sampling network and a study of the concentrations as a function of wind direction revealed that local nonferrous metallurgical plants were possibly the main source of the excess mercury and cadmium. In an effort to trace other possible sources, world wide emission inventories for both elements were investigated. On a global basis natural sources seem to dominate over pollution sources for mercury but the reverse is true for cadmium. In Belgium, however, both elements seem to be mostly of pollution origin. For mercury this is most probably combustion of fossil fuels and non-ferrous metallurgical plants, while for Cd the latter seem to be most important. A measurement of the mass-particle size function revealed that mercury is primarily associated with the smallest particles and Cd with somewhat larger particles. (auth)

10501 (EUR-5075, pp 179-190) DETERMINATION OF CADMIUM AND MERCURY IN CATTLE FOODSTUFFS, MILK AND DAIRY PRODUCTS: PRELIMINARY RESULTS. Bruant, C. (CEN, Grenoble, France); Bruant, J. P.; Neuburger, M.; Vassal, L.; Fourcy, A.; Bittel, R. 1973. (In French).

From European colloquium on the problems posed by the contamination of man and his environment by mercury and cadmium; Luxembourg (3 Jul 1973).

The animal acts as an intermediary between raw vegetable products and the foods eaten by man. In the case of radionuclides, milk and dairy products are essential carrier foods. It seems logical to investigate whether a similar problem exists in the case of mercury and cadmium. Because of the difficulties presented by analysis procedures and of the sensitivities being studied, we chose radioactivation analysis for mercury and atomic absorption spectrophotometry for cadmium. The techniques used are described. The preliminary results obtained give an indication of which dairy products would still be suitable for consumption in the event of high-level contamination of the environment by mercury and cadmium. (auth)

10502 (EUR-5075, pp 401-406) USE OF NEUTRON ACTIVATION FOR DETERMINATION OF SUBNANOGRAMS OF MERCURY AND FOR ESTIMATION OF TOTAL MERCURY ASSIMILATED IN THE POPULATION THROUGH FOOD. Diehl, J. F.; Schelenz, R. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). 1973. (In German).

From European colloquium on the problems posed by the contamination of man and his environment by mercury and cadmium; Luxembourg (3 Jul 1973).

For the purpose of ascertaining the amount of quicksilver present in the population, conditioned by food intake, the Hg content of a large number of individual items can be measured and the average Hg intake worked out on the basis of official statistics of food consumption; another way is to determine the Hg content of the daily total food intake of the normal consumer by taking individual eating and drinking habits into consideration. We have worked out the average mercury intake by both methods. As a method of analysis, neutron activation was selected on account of its high specificity and susceptibility to proof. (auth)

10503 (IAEA-R-1020-F) APPLICATION OF RADIOACTIVATION METHODS TO THE DETERMINATION OF TRACE QUANTITIES OF GOLD IN ROCKS, MINERALS, WATER, AND PLANTS. Part of a Coordinated Program on the Use of Activation Analysis in Geochemical and Geobotanical Prospecting for Ores and Minerals. Final Report for the Period 1 July 1971–30 June 1973. Lemne, M. (International Atomic Energy Agency, Vienna (Austria)). Jul 1973. 43p. INIS.

Neutron activation analysis with radiochemical separations was the method used for determining trace contents of gold in rocks, waters, and plants. The method is described and results of analyses of samples collected from known gold-bearing and nongold-bearing zones are given and compared. Some plants were identified as useful gold indicators. (INIS)

10504 (IAEA-R-1137-F) NEUTRON ACTIVATION ANALYSIS AS APPLIED TO THE ANALYSIS OF MINERALS FOR MACRO CONSTITUENTS. Part of a Coordinated Program on Nuclear Detection and Analysis. Final Report for the Period 1 January 1972–31 December 1973. Santos, G. Jr.; Yulo, M. (International Atomic Energy Agency, Vienna (Austria)). Apr 1974. 13p. INIS.

Instrumental neutron activation analysis (INAA) was used in the analysis of local ores. Procedures were developed and successfully adopted in the determination of vanadium and manganese in widely occurring Philippine magnetite sands, uranium in copper-molybdenum ore deposits, gold in gold-bearing ores, and antimony and arsenic in copper ores. The work was carried out in the period between January 1972 and December 1973 under an Agency coordinated research program, the primary objective of which was to be able to help the geologists or other prospectors by analyzing field samples in the shortest possible time and giving them an approximation of the elements of interest. The precision of the method used in determining vanadium and manganese

is acceptable. Coefficient of variation varies from 2% to 12% and 1% to 25% for vanadium and manganese respectively. The graph of the specific activity (determined at 0.61-MeV γ peak) versus $\%U_3O_8$ is a reasonably accurate and economical means of determining the uranium content in uranium-bearing geological samples. The 0.412- and 0.676-MeV γ's of ^{198}Au, and the characteristic x-ray gave a well-defined spectrum after five days of cooling. The limit of sensitivity for gold is about 0.50 ppm. The total activities due to ^{76}As and ^{124}Sb in synthetic samples of varying As-Sb proportions were counted and from these the individual activities of the two interfering nuclides were deduced. The accuracy of the method, however, is fairly dependent on the Sb-As ratio in the sample. (INIS)

10505 (ICP-1056, pp 40) ISOTOPIC SOURCE ASSAY SYSTEM. Hill, A. C. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

The Isotopic Source Assay System (ISAS) is a nondestructive assay system that quickly and accurately measures fissile material and under certain conditions, the fertile material content of materials commonly found throughout the nuclear industry. The ISAS subjects the sample to a stream of interrogating neutrons from an isotopic source (^{252}Cf), and measures the radiation (mostly gamma rays and some neutrons) emitting from the sample during interrogation. (WHK)

10506 (IFA-RT-5-1974) DETERMINATION OF OXYGEN CONCENTRATIONS IN METALS BY ACTIVATION WITH 14 MeV NEUTRONS. Racataian, I.; Postelnicu, C.; Mociornita, G.; Biciolla, L.; Brezeanu, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

A method for the continuous determination of oxygen in steel using neutron activation is described. The principles of the method are outlined and the experimental apparatus is described. The values obtained for various types of steel are analyzed to evaluate the performance of the measurement installation. (JSR)

10507 (INIS-mf-1361) APPLICATION OF HIGH RESOLUTION GAMMA AND X-RAY SPECTROMETRY TO QUANTITATIVE ACTIVATION ANALYSIS. Mantel, M. (Hebrew Univ., Jerusalem (Israel)). Jun 1973. 92p. (In Hebrew). INIS.

Thesis.

The purpose of the present work was to overcome in the quantitative activation analysis the interferences caused by high background, Compton edges, pair production, bremsstrahlung, etc., or at least to diminish their influence, by developing suitable methods based on novel techniques and principles. Gamma Spectrometry: the properties of the recently developed semiconductor Ge(Li) detectors have made high-resolution gamma spectrometry possible. In the present work these properties have been used to develop a new technique based on the principle of peak ratio determination. A specific case is the determination of isotopic ratios of elements whenever two or more of the isotopes lead, upon radioactivation, to easily identifiable species. A method for the determination of the isotopic composition of uranium has been developed. The ratios of the peak intensities of ^{239}Np obtained from ^{238}U by activation and those of fission products formed from ^{235}U are proportional to the $^{238}U/^{235}U$ ratio in the sample. A precision of ±0.6% has been obtained from a single measurement. Another method has been developed for the nondestructive determination of thorium in rocks and ores, in the presence of uranium and the rare earths. X-ray Spectrometry: the possibility of applying x-ray spectrometry to neutron activation analysis has been investigated. It was concluded that the method has several advantages which are a result of the basic properties of x-rays as well as those of the Si(Li) detectors used in the measurements. After a series of measurements throughout the periodic table it was found that 59 elements may be determined by neutron activation followed by x-ray spectrometry. Forty-five of these elements were studied and the yield of x-ray production by neutron activation in the IRR-1 reactor was determined. The sensitivity of detection for each element was expressed as the specific activity obtained for 5 minutes irradiation, a neutron flux of 10^{12} n cm^{-2} sec^{-1}, 1 to 4% counting geometries and extrapolated to zero time after irradiation. High detection sensitivities (10^4 to 10^5 dps/g) were obtained for elements such as: Ir, Pd, Rh, Nb, Br, Co, Eu, Dy. For another group of elements (Nb, Rb, Cu) the sensitivities obtained were much higher than those obtainable by γ-spectrometry. The influence of high energy γ-rays and bremsstrahlung on the measurement of x-ray has been studied. Experiments were carried out to overcome the interference of bremsstrahlung by deflection by magnetic fields of the β particles responsible for their formation. Nondestructive methods for the determination of uranium, thorium, and the rare earths were developed. The different sources of error as well as the optimal conditions of measurement and calculation were studied. (auth)

10508 (INIS-mf-1556) ACTIVATION ANALYSIS OF FLUORINE AND STRONTIUM IN BIOLOGICAL MATERIALS WITH HIGH-ENERGY PHOTONS. Pfeiffer, W. C. (Rio de Janeiro Univ. (Brazil). Instituto de Biofisica). 1972. 91p. (In Portuguese). INIS.

Thesis.

An evaluation was made of the possibilities of employing high-energy photons for activation analysis in biological material without chemical treatment, the identification of microconstituents in biological material that can be determined by this process, and its application to practical problems where it may offer some advantages in relation to conventional processes. (INIS)

10509 (KFK-2024) FAST SEPARATION OF RADIOIODINE FROM WASTE WATER SAMPLES AND DETERMINATION OF THE ^{129}I CONCENTRATION BY NEUTRON ACTIVATION. Schuettelkopf, H.; Fessler, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Strahlenschutz und Sicherheit). Apr 1974. 40p. (In German). Dep. NTIS (US Sales Only) $5.00.

A method of assaying for ^{129}I was developed, which allows radioiodine to be quickly separated from waste water samples. The ^{129}I concentration is measured by neutron activation. The idodine contained in the sample and the ^{131}I added for determination of the yield are reduced to I^-. Next, the waste water is passed over a column with AgI-impregnated SiO_2 granulate. The AgI catalyst is irradiated with approximately 5×10^{15} thermal neutrons/cm^2. The 536 keV gamma line of ^{130}I is measured by means of a Ge(Li) detector either directly or after separation of the iodine from the AgI catalyst. Radioiodine is separated from the water samples with an efficiency of approximately 95%. Up to 10 assays can be carried out by a person within 1 ½ hours. If the AgI catalyst is measured directly, the lower limit of detection achieved corresponds to 2% of the MPC of ^{129}I in water. After separation of the radioiodine from the spurious gamma emitters, ^{110m}Ag and ^{24}Na, the lower limit of detection attained is 0.07% of the MPC. (auth)

10510 NEUTRON ACTIVATION ANALYSIS TABLES. Leclerc, J. C.; Cornu, A. Philadelphia; Sadtler Research Laboratories, Inc. (1974). 68p. (In French and English).

The book comprises three sections. Part 1 is devoted to general information about the elements, atomic number and symbols, atomic weights, natural isotopes and their abundances, relationship of natural isotope to radionuclide and inversely of radionuclide to natural isotope, and capture cross-sections of isotopes. Part 2 contains a list of γ energies for radionuclides classified alphabetically and in numerical order. Part 3 includes some personal research which attempts to resolve two important problems in activation analysis: the calculation of the optimum weight of standard which is required to give a suitable level of activity, and the calculation of saturation sensitivity for any given γ energy peak. (LK)

10511 METHODS OF CONTROLLING THE ATMOSPHERIC POLLUTION. Baudin, G. (CEN, Fontenay-aux-Roses, France); Darras, R.; Sutton, J. Nuisances Environ.; No. 31, 46-49(Jun 1974). (In French).

From meeting on anti-pollution techniques; Grenoble, France (2 Oct 1973).

The principal methods of controlling the atmospheric pollution are given: analysis of the impurities collected on filters using neutron activation, x-ray fluorescence, emission and absorption spectroscopy, and nuclear reactions; analysis of gaseous pollutants using chromatography coupled with mass spectrometry, and isotope dilution techniques (the isotope dilution determination of NO_2 in stratosphere is described). (FR)

10512 MOLECULAR ACTIVATION ANALYSIS. Grant, P. M. Irvine, CA; University of California (1973). 205p. University Microfilms Order No. 74-13,846.

Thesis (Ph. D.).

The disciplines of neutron activation analysis and hot atom chemistry have been combined for the purpose of obtaining molecular information from a nuclear activation process. The technique consists of increasing the amount of parent retention obtainable in the activation procedure by utilizing the hot atom cage effect—a mechanism enhanced by performing the neutron irradiation at liquid nitrogen temperature. Background chapters are given on pertinent aspects of neutron activation analysis, hot atom chemistry, and the (n,γ) nuclear reaction, and the merger of activation analysis and hot atom chemistry is discussed. After a thorough description of the experimental procedures employed, the results obtained in an examination of several recoil ^{38}Cl systems are presented. Aqueous solutions of three chlorinated organic compounds were studied over a concentration range of 0.1 to 1000 ppM, and observed retentions were seen to vary between 10 and 30% in liquid nitrogen experiments, depending upon the particular organochlorine species under investigation. Irradiations performed at room temperature, however, resulted in but nominal organic re-

tentions in most instances. The chlorinated compounds included chloranilic acid, trichloroacetic acid, and lindane (γ-BHC). Analyses of environmentally relevant compounds were performed in addition to the initial studies of test specimens, and determinations in simulated river water and seawater matrices were also conducted. The conclusions possible from this study are encouraging and indicate that molecular activation analysis could become a useful analytical tool with further research. Suggestions for future work and possible variations of the investigative technique are given. (Diss. Abstr. Int., B)

10513 ACTIVATION ANALYSIS OF IRON METEORITES. Csajka, M.; Revina, L. D.; Jukina, L. V.; Lavruhina, A. K. Magy. Kem. Foly.; 80: No. 10-11, 484-487(1974). (In Hungarian).

Comparative qualitative analysis of the metal phases of 12 iron meteorites of different origins and the quantitative analysis of the Sikhote-Alin iron meteorite are reported. From the metal phases of the investigated iron meteorites cobalt, nickel, iron, manganese, copper, gold, gallium, arsenic and iridium could be identified by nondestructive activation analysis after irradiation for 24 hours. The number of identifiable elements varied from meteorite to meteorite. The analysis of the Sikhote-Alin meteorite included the determination of aluminium after irradiation for 3 minutes. To improve the accuracy of copper determination, radiochemical separation was carried out. The data of the quantitative analysis agree well with those available from the literature. (auth)

10514 SUBSTOICHIOMETRIC DETERMINATION OF SILVER BY NEUTRON ACTIVATION ANALYSIS. Tejam, B. M.; Haidar, B. C. (Inst. of Science, Bombay). pp 55-58 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A substoichiometric method based on the extraction of Ag with Crystal Violet into benzene is described for the determination of nanogram amounts of Ag in various materials by thermal neutron activation. (JSR)

10515 PROTEIN ESTIMATION IN LARGE SEEDS USING FAST NEUTRON ACTIVATION TECHNIQUE. Rao, U. S.; Misra, S. C.; Gupta, U. C. (Bhabha Atomic Research Centre, Bombay). pp 59-64 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A nondestructive fast neutron activation technique, based on the irradiation of seeds in an ampule filled to a calibrated mark with powders of known nitrogen concentration, was used to determine the protein of large seeds. The results obtained for groundnut, maize, French bean, and soya bean seeds were in good agreement with the results obtained with crushed seeds. (JSR)

10516 MEASUREMENT OF NEUTRON FLUX AND ^{235}U CONTENT IN URANIUM SAMPLES BY SOLID STATE TRACK DETECTORS. Iyer, R. H.; Sampathumar, R.; Sagu, M. L.; Chaudburi, N. K. (Bhabha Atomic Research Centre, Bombay). pp 237-244 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The results of a systematic study on the determination of fissile materials and neutron flux measurements using the fission track registration technique are presented. ^{235}U content of several uranium samples was determined with an accuracy of ±3%. The results of flux distribution measurement in the thermal column of APSARA were in good agreement with those obtained from ^{198}Au activation followed by counting. The feasibility of using portable neutron source for estimating ^{235}U content was demonstrated. The possibility of using track detectors immersed in solutions of fissile materials for quick and accurate measurements of uranium is also described. (auth)

10517 DETERMINATION OF RARE EARTHS IN THE LUNA-16 LUNAR SAMPLE BY MEANS OF NEUTRON ACTIVATION ANALYSIS. Elek, A.; Perneczki, G.; Szabo, E.; Dogadkin, N. N. (Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete, Budapest). Magy. Kem. Foly.; 80: No. 10-11, 481-483(1974). (In Hungarian).

Concentrations of La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Ho, Er, Yb and Lu in Luna-16 lunar samples were determined by neutron activation analysis. The oxalate method of group precipitation was used and the activity of the precipitates was measured with a Ge(Li) gamma spectrometer. The results of the analysis of the lunar samples and W-1 rock standard are given and are compared with the literature data. (tr-auth)

10518 DETERMINATION OF MICROQUANTITIES OF MERCURY IN BIOMATERIALS WITH A COMPLEX ELEMENTARY COMPOSITION (NEUTRON ACTIVATION ANALYSIS). Bakulina, L. A.; Shustov, D. A. (Central Inst. for the Improvement of Doctors, Moscow). Gig. Sanit.; No. 11, 49-52(Nov 1974). (In Russian).

A method based on neutron activation analysis was developed for the determination of Hg in biological samples with a complex elementary composition. The precision and sensitivity of the method from a measurement of the β radiation were determined. The method was tested on actual biological samples of some organs and tissues (kidneys, liver, muscles, and bone marrow) of cattle. The identification of the Hg compounds was made from the half life and the energy of the β and γ radiation. (tr-auth)

10519 OXYGEN DETERMINATION IN REGOLITH SAMPLES FROM LUNA-16 BY THE ACTIVATION METHOD USING 14-MeV NEUTRONS. Kliment, V.; Vandlik, T.; Shchasnar, V. (Inst. of Physics, Bratislava). Geokhimiya; No. 10, 1571-1572 (Oct 1974). (In Russian).

The oxygen concentration in a regolith sample weighing 113.8 mg sampled by the Luna-16 was determined by neutron activation analysis at 14 MeV. The value obtained is compared with the oxygen concentration measured in other moon samples by other investigators. (JSR)

10520 NOVEL POSSIBILITIES IN THE AGRICULTURAL APPLICATION OF ACTIVATION ANALYSIS. Csoke, A.; Bakos, L.; Andras, L. (MTA Kozponti Fizikai Kutato Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 498-500(1974). (In Hungarian).

The determination of albumin content in seeds, fodder mixtures, and of more important component elements (N, P, K) in complex and mixed artificial fertilizers by means of an automated facility is discussed. (auth)

10521 MICROANALYSIS OF SURFACE LAYERS BY NUCLEAR METHODS. Mezey, G.; Nagy, T. (MTA Kozponti Fizikai Kutato Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 462-465(1974). (In Hungarian).

The identification of heavier ($Z \geq 15$) contaminants on surfaces by nuclear back scattering and of lighter ones by nuclear reactions is discussed. Study of monocrystal structures with a triaxial goniometer is also reported. (auth)

10522 PHOTOACTIVATION ANALYSIS BY RADIOACTIVE SOURCES. Csuros, M.; Veres, A. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 447-452(1974). (In Hungarian).

A method, based on the nuclear reaction (γ, γ') for the rapid identification of some elements in geological samples, drugs and archeological findings, is described. (auth)

10523 NEUTRON ACTIVATION ANALYSIS USED AS PROOF OF TRACE ELEMENTS IN CRUDE OILS ORIGINATING FROM MATZEN-AUERSTHAL, AUSTRIA. Patek, P.; Sorantin, H. Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Chemie). Allg. Prakt. Chem.; 24: No. 5,6, 87-92(May 1973). (In German). (SGAE-2093; CH-101/73).

Report also available from the SGAE Vienna, Austria.

In the present work over 60 kinds of crude oils originating from Matzen-Auersthal, Austria, were analyzed for trace elements. By nondestructive analysis the elements V, I, Cl, Br, Mn, Na, and Au could be detected by their short-lived radioisotopes. The identification of long-lived radioisotopes belonging to the elements Cr, Fe, Sc, Ag, Zr, Se, Sb, and Co was possible only after a chemical separation. During the wet ashing of different oils a volatilization of radionuclides could be observed. At last Al, Cu and Mn were determined non-destructively. A definite correlation between the amount found and certain oil wells was, however, not possible, since some oils contained traces of sediments even after centrifugation. (auth)

10524 FISSION TRACK METHOD FOR ESTIMATING URANIUM CONTENT IN ROCK-FORMING MINERALS. Mironov, A. G.; Malyasova, Z. V. (AN SSSR, Novosibirsk. Inst. Geologii i Geofiziki). Geol. Geofiz.; No. 12, 102-109(Dec 1973). (In Russian).

For English translation see the journal Geol. Geophys.

The highly sensitive method of neutron fission fragment radiography for the quantitative evaluation of the U contents in rock-forming minerals was described. The method is based on the simultaneous observation of tracks of fission fragments caused by the fission of ^{235}U and objects irradiated by them in transparent sections and on the quantitative comparison of tracks on samples and standard targets with known U content. Tables of comparative results obtained by the neutron fission fragment method and the luminescence method were given. (tr-auth)

Chemical and Spectral Procedures

Refer also to abstracts 11274, 11451, 11764, and 13503.

10525 (BARC-705) EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF URANIUM AS URANYL–BENZOATE–RHODAMINE B COMPLEX. Dubey, S. C.; Murthy, T. K. S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 16p. Dep. NTIS (US Sales Only) $4.00.

A spectrophotometric method for the determination of uranium based on extraction of the anionic complex in association with the highly colored rhodamine B Cation (RB^+) is described. For reducing the interference due to a number of cations and anions a preliminary extraction of uranium(VI) from a nitrate solution using methyl isobutyl ketone is recommended. The extract is diluted with benzene and contracted with an aqueous solution containing benzoate (pH = 4.5) and rhodamine B. The absorbance of the organic layer is measured at 555 mμ. The molar extraction coefficient is 0.9×10^5. (auth)

10526 (BARC-710) SPECTROGRAPHIC DETERMINATION OF RARE EARTH IMPURITIES IN PURIFIED SAMARIUM OXIDE. Grampurohit, S. V.; Kaimal, V. N. P. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 13p. Dep. NTIS (US Sales Only) $4.00.

A spectrographic method is described for the estimation of Nd, Eu, and Gd in purified samarium oxide. The sample is mixed with graphite and excited in a dc arc. Second order spectra are recorded using a 3.4 meter Jarrell-Ash grating spectrograph. A stall-wood jet having oxygen atmosphere is employed to suppress cyanogen bands. The estimation range is 0.01 to 0.5% having an accuracy of ±10%. (auth)

10527 (BARC-714) DETERMINATION OF BORON IN CALCIUM FLUORIDE BY CARRIER-DISTILLATION TECHNIQUE. Grampurohit, S. V.; Dixit, V. S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 13p. Dep. NTIS (US Sales Only) $4.00.

A carrier-distillation method is described for the estimation of boron in calcium fluoride. The sample is mixed with 5% copperoxyfluoride containing 500 ppM of gallium. 50 mg of this mixture is loaded in pre-arced U.C.C. 1990 (carrier-distillation) electrode and excited using 15 amp dc arc. The resulting spectra are recorded in the region 2200 to 2850 Å, on SA-1 emulsion employing Hilger Large Quartz Spectrograph. The boron line at 2497.7 Å is used and a detection limit of 0.1 ppM is attained. The precision of the method is ±12%. (auth)

10528 (BARC-715) SPECTROGRAPHIC ANALYSIS OF HIGH PURITY MANGANESE DIOXIDE. Job, V. A.; Kartha, S. B.; Krishnamurty, G.; Gopal, S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 20p. Dep. NTIS (US Sales Only) $4.00.

An emission spectrographic method is given for quantitative estimation of twenty impurities in manganese dioxide in the concentration range 1 to 100 ppM. In this method, 5% of BaF_2 is mixed with manganese dioxide as buffer for the estimation of high volatile elements such as As, Pb, B, and Cd. For low volatile elements like V, Tl, Cr, and Fe, the sample is mixed with graphite (1:1) and 30 mg of the mixture is excited in 10 amp d-c arc for 20 seconds. Spectra are recorded on a 3.4 meter JACO grating spectrograph with a reciprocal dispersion of 2.5 Å/mm. Ga 2450.07 Å and Mn 2551.8 Å and 3106.7 Å are used as internal standard lines. The mean standard deviation for various elements varies from 7% to 20%. (auth)

10529 (BARC-727) CONDUCTOMETRIC METHOD FOR ESTIMATION OF BORON IN REACTOR GRADE HEAVY (LIGHT) WATER SAMPLES. Menon, K. R.; Namboodiri, E. G. A.; Vartak, D. G. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

A simple conductometric method for the estimation of boron in reactor grade water is presented. It is observed that the variation in conductivity is proportional to the boron content of the sample. This method could advantageously be used where frequent and quick estimation of boron content in reactor grade heavy or demineralized water is required. (auth)

10530 (CEA-R-4619) MEASUREMENT OF HYDROGEN IN TRITIATED WATER BY NUCLEAR MAGNETIC RESONANCE. Reversat, G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92–Montrouge (France)). Dec 1974. 30p. (In French). Dep. NTIS (US Sales Only) $4.50.

Certain fundamental principles of NMR show which parameters affect the sensitivity of the method and the reproducibility of the measurements. These parameters are related to the relaxation times; the sensitivity is linked to the field scanning rate, and the measurement reproducibility demands a time lapse at least equal to the relaxation time between each scanning and the next. The experimental study shows the possibilities of the method, regarding sensitivity, precision and measurement speed, for the determination of hydrogen in tritiated water. (auth)

10531 (CONF-741002-P2, pp 1105-1110) X-RAY EXCITED OPTICAL LUMINESCENCE METHODS FOR THE DETERMINATION OF TRACE LEVEL RARE EARTH IMPURITIES IN CERIUM AND LUTETIUM. D'Silva, A. P.; Fassel, V. A.; Tritten, J. S.; Oestreich, G. (Ames Lab., IA).

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

It has been demonstrated that x-ray excited optical luminescence of the rare earths can be used for the quantitative determination of rare earths in a wide variety of materials. The extension of this technique to the determination of part per million level rare earth impurities in Lu_2O_3 and CeO_2 is discussed. (LK)

10532 (CONF-741120-4) MEASUREMENT SYSTEM FOR TOTAL N AND $^{15}N/^{14}N$ IN PLANT TISSUE, SOIL, AND WATER. Walker, R. L.; Walton, J. R.; Carter, J. A.; Matthews, D. R. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 18p. (SM-191/25). Dep. NTIS $4.00.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

The ability to follow the behavior of nitrogen in environmental systems has led to the development of an analytical system which can measure the quantity and isotopic abundance of nitrogen in a variety of samples. A reductive pyrolysis unit and a directional focusing 6-inch radius gas mass spectrometer were combined into the system. In the reductive pyrolysis part of the system, nitrogen species are converted to ammonia in an atmosphere of hydrogen in the presence of a heated nickel catalyst. A small amount (~5%) of the resulting ammonia is directed into a cold finger reaction vessel where it is converted to nitrogen for isotopic analysis by mass spectrometry. The ammonia is decomposed thermally to nitrogen and hydrogen employing a rhenium filament heated to 1050°C. The nitrogen from the decomposition is used for measuring the abundance of masses 28 and 29; the ^{15}N abundance is calculated from the measured ratios. The system has been used to analyze vegetation and water samples with precisions of 0.5% of the $^{15}N/^{14}N$ value at the normal isotopic range and 6% for the quantitative analysis. The minimum sample size required for a complete analysis is 20 μg of nitrogen. Three samples can be completed in an hour using multiple reaction vessels. (auth)

10533 (ICP-1056, pp 6-13) MASS SPECTROMETRY. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

The following mass spectrometric analyses were done: U, Pu, Am, Rb, Cs, Sr, Ba, Zr, Mo, Ru, Ce, La, Nd, and Sm. The likelihood of measuring the age of ruthenium particles embedded in soil-type matrices was evaluated. (LK)

10534 (ICP-1056, pp 14-15) SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN WATER USING THE MODIFIED VACUUM CUP ELECTRODE SYSTEM. Lyon, T. R.; Smith, R. A. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10535 (ICP-1056, pp 15-16) APPLICATION OF THE MODIFIED VACUUM CUP ELECTRODE SYSTEM TO THE SPECTROGRAPHIC ANALYSIS OF URANYL NITRATE SOLUTIONS. Lyon, T. R. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10536 (ICP-1056, pp 50-51) ISOTOPE DILUTION MASS SPECTROMETRY METHOD FOR DETERMINATION OF URANIUM. Murphy, L. P.; Wade, M. A. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10537 (ICP-1056, pp 64-68) INVESTIGATION OF WAYS TO REDUCE THE COST OF ASSAYING DENITRATOR PRODUCT. Schneidmiller, D.; Yamamura, S. S.; Wade, M. A. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10538 (ICP-1056, pp 69-70) COLORIMETRIC DETERMINATION OF LOW CONCENTRATIONS OF IRON IN URANIUM. Delmastro, J. R.; Murillo, P. C.; Yamamura, S. S. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10539 (ICP-1056, pp 70-74) ANALYTICAL METHODS FOR COMBINED AQUEOUS DISSOLUTION PROCESS. Delmastro, J. R.; Reeder, S. D.; Yamamura, S. S. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

To provide methods for more rapid chemical determination of zirconium, niobium, and uranium in support of the combined aque-

ous dissolution project, four approaches were initially investigated: (a) gas chromatography, (b) electrochemistry, (c) x-ray fluorescence, and (d) automation of existing ICPP extraction-spectrophotometric methods. Each of these approaches had certain deficiencies and none offered a clear-cut solution to the general analysis problem. (auth)

10540 (ICP-1056, p 75) MODIFICATION OF EXISTING METHODS FOR THE DETERMINATION OF URANIUM IN AQUEOUS AND ORGANIC SOLVENT SAMPLES. Reeder, S. D. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10541 (ICP-1056, p 76) EFFECT OF TEMPERATURE VARIATIONS ON MEASURED VOLUME DELIVERIES OF ^{233}U SPIKE AND OTHER SOLUTIONS. Curtis, G. J.; Yamamura, S. S. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10542 (ICP-1056, pp 78-81) ANALYSIS OF HTGR COATED FUEL PARTICLES FOR URANIUM AND THORIUM. Reeder, S. D.; Delmastro, J. R.; Murillo, P. C. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10543 (ICP-1056, p 81) SPECTROPHOTOMETRIC DETERMINATION OF THORIUM IN HTGR PRIMARY BURNER FINES. Delmastro, J. R. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10544 (ICP-1056, pp 81-82) SPECTROPHOTOMETRIC DETERMINATION OF THORIUM IN TBP-NPH MIXTURES. Delmastro, J. R. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10545 (ICP-1056, p 82) DETERMINATION OF URANIUM IN HTGR SAMPLES CONTAINING THORIUM. Reeder, S. D. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10546 (ICP-1056, p 85) INVESTIGATION OF INDUSTRY-WIDE POSITIVE BIAS TENDENCY OF THE MEASUREMENT OF ^{235}U BY THERMAL IONIZATION MASS SPECTROMETRY. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10547 (ICP-1056, pp 85-90) INVESTIGATION OF ^{233}U SPIKE CALIBRATION AND THE DETERMINATION OF URANIUM BY ISOTOPE DILUTION MASS SPECTROMETRY. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10548 (INIS-mf-1470) EXTRACTIVE PHOTOMETRIC DETERMINATION OF URANIUM USING BASIC DYES. Dubey, S. C. (Bhabha Atomic Research Centre, Bombay (India)). 1972. 106p. INIS.
Thesis.
The use of rhodamine-B and methylene blue has been studied for the spectrophotometric determination of uranium (VI). A simplified procedure has been worked out for the determination of uranium as benzoate complex using rhodamine-B which can be used even in presence of interfering ions. It has been found that the extraction of uranium from a nitrate solution as the trinitrate complex in presence of rhodamine-B and methylene blue using organic solvents like benzene and chlorobenzene serves as a more selective method for the spectrophotometric determination of uranium. The factors affecting the extraction and determination of uranium have been studied in detail. The methods have been tested with synthetic solutions containing added impurities. An attempt has also been made to find the molecular composition of the complexes using Job's method of continuous variation. (INIS)

10549 (INIS-mf-1571) SEPARATION OF RARE EARTHS IN URANIUM AND PRECONCENTRATION BY CHROMATOGRAPHY IN ALUMINUM. Fluorimetric Determination in Solution and in Y_2O_3 And YVO_4. Cazotti, R. I. (Sao Paulo Univ. (Brazil). Instituto de Quimica). 1973. 96p. (In Portuguese). INIS.
Thesis.
The determination of vanishing small amounts of rare earths in uranium by fluorescence spectrometry is described. The rare earth elements are separated and concentrated on a small alumina (3 ml Al_2O_3) column after percolation of $UO_2(NO_3)_2$-0.3 M HF solution whose concentration can be as high as 250 g U per liter. Thorium, if present, is also retained by the alumina. The rare earth group and thorium are eluted with hot 1 M HCl or 1 M $HClO_4$. The eluted lanthanides are determined using a solid matrix; Dy, Eu, Sm, Tm, Er, and Ho are excited in a YVO_4 matrix, and Tb, Pr, and Gd are excited in a Y_2O_3 matrix. Although the first six elements also fluoresce in a Y_2O_3 matrix, their fluorescence is considerably higher in YVO_4. Cerium, which does not fluoresce either in YVO_4 or Y_2O_3, is determined directly in the eluate. Cerium(III) is highly fluorescent in dilute inorganic acids and can be determined at concentration as low as 0.001 μg/ml. Neodymium and Yb fluoresce in Y_2O_3 matrix as well, but their fluorescence band is in the infrared region (800-1000 mm) and were not determined here. Lanthanum and lutetium are not fluorescent at all in the matrices used. The procedure has been applied to the determination of rare earths in 20-g samples of uranium and its compounds. The lower concentration of rare earth elements analyzed in uranium was (μg of lanthanide/g of U): Dy-0.0005, Eu-0.001, Sm-0.001, Tm-0.0005, Er-0.02, and Ho-0.1 in YVO_4 matrix; Tb-0.005, Pr-0.5, Gd-2.0 in Y_2O_3 matrix; and Ce-0.002 directly in $HClO_4$ solution. (INIS)

10550 (PB-230217) APPROACH TO SHOP FLOOR QUALITY CONTROL. Development of an Inspection Analyser. Ambrose, A. D. (British Steel Corp., Sheffield). Feb 1974. 20p. (TB/CC-71-12). NTIS $4.00.
A novel approach to the problem of grade identification in the plant is described. A light-weight hand-held probe delivers an electrical discharge to the component under test and is connected to a direct reading spectrometer by a flexible light guide. Using a simple dc arc source, chromium, molybdenum, manganese, and vanadium have been determined in a testing time of about 30 s with a coefficient of variation of approximately 10%. Speed of testing is often more important than exact analysis. In trials a clear separation of the three principal chromium grades (residual, 1% and 2%) was obtained in under 10 s, without any surface preparation. With the available glass light guides, there is a choice of spectral lines for most elements but carbon, sulfur and phosphorus are excluded. (GRA)

10551 PRELIMINARY STUDY OF HALIDE DETERMINATION BY MOLECULAR EMISSION CAVITY ANALYSIS (MECA). Belcher, R.; Bogdanski, S. L.; Kassir, Z. M.; Stiles, D. A.; Townshend, A. (Univ. of Birmingham, Eng.). Anal. Lett.; 7: No. 11, 751-761(Nov 1974).
A study of the determination of chloride, bromide, and iodide by MECA, using the emissions of their indium salts, is described. Linear calibration graphs are obtained in each instance, with limits of detection of 0.5 ppM (2.5 ng) for chloride and bromide and 10 ppM (50 ng) for iodide. The effects of interferences are investigated, and a standard addition method is used for the rapid estimation of chloride in drinking waters. (auth)

10552 DETERMINATION OF MOLYBDENUM BY MEANS OF AN ION-SELECTIVE ELECTRODE BASED ON BIS-TETRAETHYLAMMONIUM PENTATHIOCYANATOOXOMOLYBDATE(V). Fogg, A. G.; Kumar, J. L.; Burns, D. T. (Univ. of Tech., Loughborough, Eng.). Anal. Lett.; 7: No. 10, 629-636(Oct 1974).
Liquid state membrane electrodes based on bis-tetraethylammonium pentathiocyanatooxomolybdate(V) dissolved in nitrobenzene: o-dichlorobenzene (2:3) have been prepared and assessed. Nernstian response (29.5 mV/pMo at 25°C) was obtained in the range 5×10^{-6} M to 10^{-2} M molybdenum. Several other metal ions which form thiocyanate complexes, namely those of iron, vanadium, tungsten, niobium, and rhenium, interfere. (auth)

10553 COMPARISON OF BACKSCATTERING SPECTROMETRY AND SECONDARY ION MASS SPECTROMETRY BY ANALYSIS OF TANTALUM PENTOXIDE LAYERS. Chu, W. K. (California Inst. of Tech., Pasadena); Nicolet, M. A.; Mayer, J. W.; Evans, C. A. Jr. Anal. Chem.; 46: No. 14, 2136-2141 (Dec 1974).
Samples of anodic tantalum oxide films grown on Ta have been analyzed by backscattering spectrometry (BS), and results compared with those obtained on the same samples by secondary ion mass spectrometry (SIMS). Very good agreement was found in the determination of the film thicknesses. BS supplies this thickness information directly from energy loss data in a non-destructive fashion, whereas SIMS provides relative concentration profiles by destructive sputtering. SIMS can identify the atomic species in the film, while BS can furnish quantitative information on relative atomic concentration. The comparison stresses the complementary nature of these two analytical techniques. (auth)

10554 ISOTOPE ABUNDANCES FROM MASS SPECTRA. Rozett, R. W. (Fordham Univ., Bronx, NY). Anal. Chem.; 46: No. 14, 2085-2089(Dec 1974).
Three complementary methods to determine accurate fractional abundances of isotopes from mass spectral data are developed. The peak comparison method solves simultaneous equations which are linear in the isotope abundances. The graphical method uses techniques developed for finding least squares fit monoisotopic spectra from polyisotopic measurements. The nonlinear least squares method substitutes Gauss-Newton iterations for the

multiple passes of the graphical method. The power and limitations of each method are explored. (auth)

10555 ANALYSIS OF METHYL IODIDE, METHYL NITRATE, AND METHYL ALCOHOL IN 20 M NITRIC ACID BY GAS CHROMATOGRAPHY. Apple, R. F.; Davis, H. G.; Meyer, A. S. (Oak Ridge National Lab., TN). Anal. Lett.; 7: No. 10, 671-674(Oct 1974).

A method for the determination of methyl iodide, methyl nitrate, and methyl alcohol in 20 M nitric acid solutions by gas chromatography has been developed. The separation and subsequent determination are dependent on proper conditioning of the column with water. Satisfactory determinations were carried out in aqueous and 20 M nitric acid media. (auth)

10556 ION MASS SPECTRA. Wilson, R. G. New York; John Wiley and Sons, Inc. (1974). 438p. $4.95.

A collection of 404 ion mass spectra for over 100 elements and compounds ionized in a low-voltage, moderate pressure, hot filament electron bombardment ion source is presented. The experimental conditions under which the data were obtained and the ion source and feed systems used are described. Methods of identifying and calibrating the masses of the ion components in these spectra are described. Selected data for elemental ions are tabulated, together with data on ionization potentials and vapor pressures of elements. A cross-referenced index of selected ion species and page numbers is included. (JGB)

10557 TRACER STUDIES IN RECOVERY OF IMPURITIES FROM ARSENIC AND THEIR SPECTROGRAPHIC ESTIMATION. Joshi, B. D.; Dalvi, A. G. I.; Bangia, T. R. (Bhabha Atomic Research Centre, Bombay). pp 125-132 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The recovery of impurities from As and their spectrographic determination were studied for the impurities Co, Sn, Mn, Ba, Cd, Hg, and Sb using radioisotopes of these elements as tracers. The As with known impurity concentrations was volatilized as As_2O_3. The residue containing the impurities and As traces was dissolved, evaporated to dryness, redissolved and then aliquot samples were used for the spectrographic determination. The γ counting of the residues showed that Co, Mn, Ba, and Cd were recovered quantitatively, and only slightly less for Sn. The recovery of Sb and Hg was very small. The spectrographic determination showed that quantitative results were obtained for all elements except Hg and Sb. (JSR)

10558 ELEMENTAL ANALYSIS OF BULLET LEAD BY SPARK SOURCE MASS SPECTROMETRY. Haney, M. A.; Gallagher, J. F. (FBI Lab., Washington, DC). Anal. Chem.; 47: No. 1, 62-65(Jan 1975).

Bullet lead has been analyzed by SSMS for all elements found at the 0.1-ppM level and above. Photographic detection was used to identify 26 commonly occurring elements and to establish which ones are suitable for quantitative determination. Analysis of a standard lead sample for selected homogeneous elements yielded an average precision of 9% RSD. Electrical detection by magnetic peak switching gave a precision of 5.7%, indicating that this method is to be preferred for a limited set of elements. A simple isotope dilution method was investigated for the elements Cu, Ag, and Sb. The precision ranged from 5 to 25% RSD, with the accuracy being well within the standard deviation of the mean in all cases. The three techniques of SSMS are shown to be particularly complementary in this problem, combining to give a complete elemental analysis with moderate accuracy. (auth)

10559 AMPEROMETRIC METHOD OF DETERMINATION OF SELENIUM AND TELLURIUM USING K-DITHIOTRIHYDROXYMETHYL AMINOMETHANE. Chaudhuri, H.; Chatterjee, S. S.; Mahanti, H. S. (Banaras Hindu Univ., India). Technology (Sindri); 10: No. 3-4, 264-266(1973).

A new amperometric method for the determination of selenium (IV) and tellurium (IV) with K-dithiotrihydroxymethyl aminomethane has been developed, using ammonium tartrate-potassium nitrate (pH 7.5) as the supporting electrolyte. The titrations were carried out at −0.2V vs S.C.E. at the dropping mercury electrode. The method is simple, precise and easily adoptable. The accuracy of the procedure is comparable with that of conventional methods. (auth)

10560 N-BENZOYL-O-TOLYLHYDROXYLAMINE AS A GRAVIMETRIC REAGENT FOR BERYLLIUM. Das, M. K.; Chakraborti, D. (Jadavpur Univ., Calcutta). Indian J. Chem.; 12: No. 7, 773-774(Jul 1974).

Beryllium can be determined gravimetrically using N-benzoyl-o-tolylhydroxylamine, by direct weighing as $Be(C_{14}H_{12}O_2N)_2$, the gravimetric factor being 0.01952. The pH range for complete precipitation is 6.3 to 8.7. The metal can be separated from a number of diverse ions either by masking with EDTA or by adjustment of pH. (auth)

10561 URANIUM ANALYSIS BY LUMINESCENCE TECHNIQUE. Sergeev, A. M.; Yufa, B. Ya.; Gubanova, G. F.; Kryuchek, M. T. Tazved. Okhr. Nedr; No. 1, 21-23(Jan 1974). (In Russian).

The characteristics of different methods for the analysis of U in rocks by the luminescence method are given in tabular form. These data can be used for the selection of the optimum method of analysis. Recommendations were made as to the optimum method for different U concentrations. (tr-auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 11264, 11316, 11329–11334, 11341, 11391, 11394, 11396, 11459, 11499, 11542, and 11687.

10562 (AEC-tr-7592, pp 79-81) METHOD OF ^{90}Sr DETERMINATION OF BOTTOM SAMPLES. Vinogradova, V. K.; Gedeonov, L. I.; Rosyanov, S. P. Dec 1974. Translated from pp 123-127 of Radioekologiya Vodnykh Organizmov. Vol. 3. Vliyanie Ioniziruyushchei Radiatsii Na Gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The method proposed for the determination of ^{90}Sr of river bottom samples is based on the precipitation of the alkaline metal sulfates in the presence of acetone, removal of other elements and fission products, addition of Y carrier, and precipitation of the Sr with Y after radioactive equilibrium is reached. The final oxalate precipitate is calcined to Y_2O_3 and the β activity measured. The radiochemical yield of Sr is determined by flame photometry. The ^{90}Sr can be determined at a level of 10^{-10} Ci/kg with an accuracy of at least 20%. (JSR)

10563 (BARC-729) DETERMINATION OF CALCIUM IN URANIUM BY X-RAY FLUORESCENCE METHOD. Dixit, R. M.; Kapoor, S. K.; Deshpande, S. S. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

An x-ray fluorescence method for the analysis of calcium in uranium in the range of 20 to 500 ppM is described. U_3O_8 samples in the form of double layer pellets are analyzed by using a Philips PW-1220 semiautomatic X-ray spectrometer. The average accuracy and precision of the method are within ±5%. (auth)

10564 (EUR-5075, pp 203-209) DETERMINATION OF CADMIUM IN AIR PARTICULATE MATTER BY X-RAY FLUORESCENCE. Some Air Cadmium Concentrations in the Netherlands. Minderhoud, A.; Boogerd, J. P. (Rijks Instituut Voor de Volksgezondheid, Bilthoven, Netherlands). 1973.

From European colloquium on the problems posed by the contamination of man and his environment by mercury and cadmium; Luxembourg (3 Jul 1973).

Air particulate matter is collected automatically on cellulose filter tape (Whatman No. 1 or Whatman No. 40). The samples are analyzed by X-ray fluorescence. Cadmium Lα intensities (3.96 Å) are measured using excitation with a chromium X-ray tube and crystal dispersion. The measured intensities are compared with the intensities of standard filters, prepared by impregnating filter paper with a $CdSO_4$ solution. As particulate matter in air pollution sampling is deposited mainly on one side of the filter, all filters have to be measured on both sides. The intensities are averaged, and for calculation of the concentrations a correction factor is applied. This factor is evaluated experimentally. The lower limit of detection, defined as the amount of cadmium, emitting a characteristic intensity equal to three times the standard deviation of the background is 0.04 μg Cd/filter (measuring time 100 sec). Concentrations of a number of other elements can be measured in the same sample. Some of the air samples are also analyzed using flame atomic absorption spectrometry, after wet destruction. The results agree quite well. Air cadmium concentrations in some urban and rural areas in the Netherlands are given. (auth)

10565 (ICP-1056, pp 16-19) DETERMINATION OF THORIUM IN TBP–NPH MIXTURES BY X-RAY FLUORESCENCE. Rothenberg, A. M. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10566 (ICP-1056, pp 20-22) COMPARISON OF THE USE OF STABLE ^{148}Nd WITH RADIOACTIVE FISSION PRODUCTS TO DETERMINE BURNUP IN PBF TERNARY FUEL. Staples, B. A.; Wilcox, C. M.; Fortsch, E. M. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10567 (ICP-1056, pp 22-23) ANALYSIS OF PBF TERNARY FUEL ROD SECTIONS. Hill, A. C.; Wilcox, C. M.; Hunter, B. R. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10568 (ICP-1056, pp 28-33) ICPP SERVICE WASTE RADIONUCLIDE ANALYSES. Filby, C. W.; Hinckley, L. R.; Weinrich, L. A. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10569 (ICP-1056, p 33) DETERMINATION OF APPROXIMATE URANIUM ENRICHMENT IN GRAPHITE ROVER FUEL. Hill, A. C.; Wilcox, C. M. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10570 (ICP-1056, p 41) ANALYSIS OF ROVER NERVA FUEL. Fortsch, E. M.; Wade, M. A. Oct 1974.
In Analytical Chemistry Branch annual report, fiscal year 1974.

10571 (INIS-mf-1496) RAYLEIGH-SCATTERING AS AN INTERNAL STANDARD IN X-RAY FLUORESCENCE SPECTROMETRY. de Kreuk, H. (Rijksuniversiteit Leiden (Netherlands)). 19 Jun 1974. 74p. (In Dutch). INIS.
Thesis.
During the past 15 years use has been made of the coherent scattered primary x-rays for dealing with matrix effects and with certain other errors in x-ray spectrometry. In chapter I a general introduction about x-ray spectrometry and a review of the most important published applications is presented. In the following chapters the possibilities of standardization by means of scattered primary x-rays are systematically studied. In chapter II the influence of spectrometer adjustment on the measured intensity of a secondary line is described. It is made evident that in general the scattered primary x-rays are useful for correction of deviations from the correct spectrometer adjustments. In chapter III the author proves that it is difficult to estimate systematically the possibilities of correcting matrix effects. In some cases however, scattered radiation is useful. The wavelength of the scattered primary radiation, used for the correction, must be selected by "trial and error." An effective mathematical calculation of particle size effects in non-diluted powdered samples has not been developed so far. In chapter IV, therefore, a mathematical discussion of the particle size effect in non-diluted samples is presented, using two-particle models. The experimental results agree well with the average of the two models. Correction for the particle size effects by means of scattered primary radiation is not complete. The same restrictions as in chapter III hold here. Finally in chapter V the influence of variation in sample size and sample thickness on the intensity of a secondary line is investigated. The scattered primary x-rays are useful for correction of variation in sample thickness, if there is only a little difference between the mass absorption coefficients of the sample for primary and secondary radiation. We can also correct variations in the sample size especially if we use a scattered primary line at short wavelength. In this case the influence of the scattering of primary radiation by the mylar film, used as window material in the sample holders, is negligible. It follows from this investigation, that the described correction method is useful for variation in spectrometer adjustment and variation in sample size and sample thickness. This result is important for analysis of samples that are not allowed to be destroyed, such as samples of archeological or artistic importance. A systematic approximation to the possibilities of matrix effects and particle size effects is difficult. The correction method can be used once a suitable wavelength of the scattered primary radiation has been selected. In the last section of each chapter the most important conclusions are reported in Dutch and in English. (INIS)

10572 (SAND-74-5425) SOLID STATE SURFACE ANALYSIS BY ION BACKSCATTERING AND CHANNELING. Picraux, S. T. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 21p. (CONF-741040-7). Dep. NTIS $4.25.
From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).
Examples of the applications of ion backscattering to anodization studies and to resistor films for microelectronics circuits are given. Depth profiling is demonstrated for applications to dopant diffusion and to metal contact reactions with semiconductors. By combining ion channeling together with backscattering measurements, crystallographic information such as the degree of crystal disorder and the lattice location of impurities can be obtained. Examples are given of studies of heteroepitaxial layer quality and of implanted impurity atom location. (auth)

10573 (UCRL-75659) Ge(Li) SPECTROMETRIC MEASUREMENTS OF ISOTOPIC URANIUM RATIOS IN SOILS TREATED WITH APATITE-DERIVED FERTILIZERS. Lindeken, C. L.; Coles, D. G.; Meadows, J. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Sep 1974. 18p. (CONF-741120-2). Dep. NTIS $4.00.
From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).
Soil samples collected in an agricultural region of the Sacramento–San Joaquin Delta in central California contained levels of uranium as high as 17 ppM. Isotopic uranium analysis, determined by mass spectrometry, showed $^{235}U/^{238}U$ ratios of 7.1×10^{-3}, typical of natural uranium. However, the ^{238}U content inferred from gamma counting of the ^{226}Ra daughters disclosed marked disequilibrium in the ^{238}U decay series. The elevated levels of uranium are attributed to its presence in ammonium phosphate fertilizer produced from apatite [$CaF_2Ca_3(PO_4)_2$]. The ^{238}U daughter disequilibrium is due to removal of ^{226}Ra by coprecipitation with $CaSO_4$ during conversion of the raw material to phosphoric acid with sulfuric acid. A more direct method for ^{238}U measurement based on detection of the 63-keV transition gamma of ^{234}Th and using Ge(Li) gamma spectrometry is described. This method is independent of ^{226}Ra daughters and can detect ^{238}U down to about 0.1 $\mu g/g$ in soils. A comparison with ^{238}U measurements using mass spectrometry shows agreement within ±10%. (auth)

10574 LIQUID SCINTILLATION COUNTING. Volume 3. Proceedings of a Symposium, Brighton, England, September 3–6, 1973. Crook, M. A.; Johnson, P. (eds.). London; Heyden (1974). 306p. £ 10.00.
Proceedings of the conference were divided into four parts: modern concepts in liquid scintillation counting; quench correction techniques; sample preparation, Part 1; sample preparation, Part 2. Twenty-eight papers were presented of which 27 were in NSA scope and for which separate abstracts were prepared. (UK)
For abstracts of individual papers see: 10575–10595 and 11329–11334.

10575 APPLIED LIQUID SCINTILLATION COUNTING. Horrocks, D. L. (Beckman Instruments, Inc., Fullerton, CA). pp 3-20 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).
From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).
The basic steps that comprise the scintillation process are outlined. The composition of a typical scintillator solution and the roles of the solvents and solutes are considered. The excitation processes which occur in the scintillator solution and the energy transfer involved are explained. The scintillation efficiency, defined as the fraction of the energy of the exciting particle which is converted into photon energy, is discussed. The determination of absolute disintegration rates of α particles, β emitters, conversion electron sources, γ sources, neutrons and fission fragments is considered. The determination of β spectra and pulse shape discrimination are mentioned. (UK)

10576 LIQUID SCINTILLATION COUNTING OF RADIONUCLIDES USED IN RADIOIMMUNOASSAY. Horrocks, D. L. (Beckman Instruments, Inc., Fullerton, CA). pp 28-33 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).
From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).
The measurement of radionuclides used in radioimmunoassay and radioassay diagnostic tests that decay by β emission followed by γ emission (in particular ^{131}I, ^{60}Co, ^{59}Fe and ^{22}Na) and those that decay 100% by electron capture (in particular ^{125}I, ^{57}Co and ^{51}Cr) is considered. They can all be measured with high efficiency in a liquid scintillator system. However, there are two main concerns that have to be considered. First, it is necessary to monitor all samples for quench differences between samples with subsequent computation of a quench correction. The second concern involves the possibility of contamination of the liquid scintillation counter with γ-emitting radionuclides. (UK)

10577 STANDARDISATION IN LIQUID SCINTILLATION COUNTING. Mueller, E. B. pp 47-64 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).
From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).
The pitfalls encountered when automation of liquid scintillation counting is undertaken are considered. If the operator is willing to abandon the capability of counting many different forms of sample the use of automation might be acceptable. Since this is not acceptable, an alternative is to provide an appropriate standard for each different sample "form". In order to identify the determinants of "form" an expression is given for the magnitude of the electrical pulse produced in the counter by an event in the sample and the implications and derivations of each factor of the expression fully considered. (UK)

10578 COLOUR QUENCHING BY CAROTENOIDS. Bramley, P. M.; Davies, B. H.; Rees, A. F. (University Coll. of Wales, Aberystwyth). pp 76-85 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

In studies on the biosynthesis of carotenoids, radioactive substrates (labelled with ^{14}C and ^{3}H) are used as precursors of the carotenoids in whole organisms or in enzyme studies. Although solubility in scintillators presents no difficulty the very nature of these pigments dictates that such samples interfere with the basic liquid scintillation process by causing color quenching. The availability of liquid scintillation counters equipped with automatic external standards has enabled the exploitation of the external standard channels ratio (ESCR) method in correcting both for chemical and for color quenching. Quench correction curves have been established in order to use this method for counting ^{14}C and ^{3}H in carotenoid samples using ten different carotenoids which, between them, have a wide variety of absorption maxima covering the entire wavelength range of phosphor emission and photomultiplier sensitivity. The data presented justify the use of the ESCR method of correcting for color quenching by a wide variety of these pigments. One set of correction curves is applicable to all the compounds of this class examined, and it is unlikely that any others are sufficiently powerful chemical quenchers to introduce inaccuracies into the results and so necessitate an alternative approach. As long as the limitations of the technique, with regard to very high degrees of quench and to doubly labelled samples, are appreciated, the method is as accurate and is certainly more convenient than other procedures available. (UK)

10579 HOMOGENEOUS COUNTING. Gordon, B. E. (Koninklijke Shell, Amsterdam). pp 109-121 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A homogeneous sample is defined as a sample in which the composition of the volume traversed by the emitted radiation is, for all practical purposes, the same everywhere. A review is given of homogeneous sample preparation for gas, inorganic, and organic samples, and it is concluded that all these can be successfully analyzed. However the operator must be aware that a homogeneous appearance may be desirable, but is not a sufficient, condition for accurate radioassay. It also may not be necessary if the β-energy is large compared to the particle size. Adsorption and deposition of the radionuclide must be ruled out by careful testing. Extremely low concentrations of a labelled sample should be avoided because the adsorption capacity of the vial wall is high enough to cause significant errors. The situation is far more hazardous with high molecular weight polar molecules which may be irreversibly adsorbed. Since the physical behavior of these molecules is usually unpredictable it is safest to burn such samples and analyze the products of combustion in one of several proven scintillation cocktails. The virtue of sample combustion lies not so much in the opportunity to count these homogeneously as in the fact that the radionuclides are in a known chemical form for which a suitable counting system is available. Two major advances in combustion instrumentation, the flow oxygen flask and the high speed combustion train, go a long way towards overcoming objections to this method of homogeneous sample preparation. (UK)

10580 SOLUBILISATION OF MAMMALIAN TISSUE FOR SCINTILLATION COUNTING. Dent, J. G. (Wellcome Research Lab., Beckenham, Eng.); Johnson, P.; Keynes, M. pp 122-131 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

Difficulties normally experienced in the preparation of large numbers of samples of tissue for ^{14}C and ^{3}H analysis by liquid scintillation methods are outlined. In an effort to overcome these difficulties a number of methods and solubilizer/scintillator combinations were tested and the results using rat tissue are tabulated. It was shown that none of the methods investigated are generally superior to any other except in terms of time and cost. The assays of in vivo-labelled tissue indicate that the results obtained by solubilization differ from those obtained by combustion, in some cases by up to 12% for ^{14}C and by up to 40%, but more generally about 15% for ^{3}H. These discrepancies may be due to different interactions between the various solubilizers and metabolites of glucose. It is considered that perchloric acid, and SHT in conjunction with either tT21 or scintillator S.20 conform to the requirements of an ideal solubilizer and are inexpensive. Combustion of samples is not practicable where large numbers are involved. It is shown that with some types of samples and some solubilizers agreement with combustion methods is very good, but with other samples there can be large discrepancies, for reasons as yet unknown. (UK)

10581 AUTOMATED TUBE FURNACE COMBUSTION FOR LIQUID SCINTILLATION SAMPLE PREPARATION. Rapkin, E. pp 132-149 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

In the past combustion methods of sample preparation for liquid scintillation counting have given excellent results for a limited number of samples but have not been converted to the automatic or semi-automatic basis which would make such methods attractive to the typical laboratory. Recently the Peterson system was described [Paterson et al., Anal. Biochem. 31, 189 (1969) and Paterson, Anal. Biochem. 31, 204 (1969)]. This system incorporates vertical tube furnace combustion in which substances containing ^{3}H and ^{14}C can be combusted and the combustion products, trapped in appropriate counting fluids, automatically collected in counting vials which need only be manually capped before being counted. The Oxymat, here described fully, is a direct descendent of the Peterson apparatus. Several refinements have been added and it is now a commercial product. The performance of the apparatus is discussed with reference to precision, recovery, linearity with sample type, memory, linearity with sample size, counting efficiencies and dual isotope separation. Some user experience is considered. (UK)

10582 SEMI-AUTOMATIC IN-VIAL COMBUSTION WITH THE MICRO-MAT SYSTEM. Wegner, L. A.; Winkelmann, H. (Bayer AG, Isotopen-Institut, Wuppertal, Ger.). pp 150-157 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A modification of Gupta's "in vial" combustion method [Analyt. Chem., 38, 1356 (1966)] with respect to the manual handling of large numbers of samples for liquid scintillation counting is described. This is the "Micro-Mat" system, a device for the semi-automatic combustion of organic material. The combustion equipment, weighing system, and computer data handling process are fully described. Results of performance testing of the Micro-Mat system using ^{14}C and ^{3}H labelled biological materials are given. Additionally the Micro-Mat can be used in the quantification of the autoradiography of whole-body sections of small animals and also can be used for the repeated determination of the time-dependent activity concentration in the blood of a rat. (UK)

10583 SAMPLE PREPARATION WITH AN AUTOMATED OXYGEN FLASK COMBUSTION APPARATUS FOR LIQUID SCINTILLATION COUNTING OF ^{3}H-, ^{14}C-, AND/OR ^{35}S-LABELLED MATERIAL. Rauschenbach, P.; Simon, H. (Technische Univ., Munich). pp 158-163 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

An automated oxygen flask combustion apparatus for sample preparation for liquid scintillation counting of ^{3}H, ^{14}C and ^{35}S labelled material is described. The apparatus is commercially designated "Pyroszint". The advantages of the system over the classical flask combustion are the oxygen flush of the flasks, the ignition and the delivery of defined aliquots of scintillator-absorbent solution are completely automated. No cooling materials are needed whatsoever; singly labelled, and either $^{3}H/^{14}C$ or $^{3}H/^{35}S$ doubly labelled samples can be analyzed by a single procedure. A comparison of the advantages and disadvantages of the automated oxygen flask combustion and oxygen stream technique is given. (UK)

10584 COMPARISON OF COMBUSTION TECHNIQUES USED IN THE PREPARATION OF ^{14}C-LABELLED SAMPLES FOR LIQUID SCINTILLATION COUNTING FROM BIOLOGICAL MATERIALS. Cooper, R. G. (Imperial Chemical Industries Ltd., Macclesfield, Eng.). pp 164-174 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A comparison is made of combustion techniques used for the preparation of ^{14}C-labelled biological material samples for liquid scintillation counting. The methods and apparatus which are described include the Peets and Florini tube furnace using either a Kalberer-Rutschmann or a Dobbs flask, the Packard 305 Sample Oxidizer, the Intertechnique Oxymat Sample Oxidizer and the Packard 306 Sample Oxidizer. It is concluded that the oxygen

flask technique stands out for its reliability. Bearing in mind the time wasted on breakdowns and maintenance of commercially available equipment, manual techniques can often be quicker and cheaper in the long run. (UK)

10585 HETEROGENEOUS COUNTING SYSTEMS. Tarkkanen, V. pp 177-201 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

It is pointed out that due to the general inability of organic solvents to dissolve aqueous biological systems another approach was found necessary in sample preparation of such material for liquid scintillation counting. Heterogeneous counting systems, those in which the bulk of the sample is not in the same phase as the bulk of the scintillator, are now recognized as realistic possibilities in obtaining final samples with high load and efficiencies. Comparative data are presented of the properties of available heterogeneous counting systems capable of reproducible counting. The stability of commercial and experimental formulations for temperatures of between 8 and 21°C, comparison of relative counting efficiencies of equivalent loads of various samples in different formulations and the dependence of physical characteristics on temperature and sample load for a number of formulations are given. It is stated that by using the recommended sample preparation method and the usable sample load ranges the behavior of a modern colloidal scintillator is similar to any ideal homogeneous sample. A Figure of Merit [the product of the counting efficiency (in percent) multiplied by the percentage of the sample load] was used to compare counting systems for tritium in water and the comparisons are given. (UK)

10586 OPTIMISATION IN COLLOID SCINTILLATION COUNTING. Fox, B. W. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). pp 202-210 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A method of measuring very low specific activity solutions is discussed given the fact that several milliliters of the aqueous solution is available. To be able to compare one ternary counting system (aqueous sample, detergent, hydrocarbon solvent) with another and to be able to judge the general properties of a scintillant system with regard to its general counting and stability characteristics contour diagrams were prepared. Contour diagrams for a number of properties and for a number of ternary systems are shown. The two criteria of primary importance in liquid scintillation counting are the merit value (the product of percentage efficiency and the percentage of sample) and the counting stability. These are discussed with reference to contour diagrams. It is shown that with PPO/POPOP as solutes, Triton X100 shows the best potentialities for the most sensitive detection of ^{3}H-H_2O. (UK)

10587 RELIABILITY OF ESTIMATING ^{14}C IN BIOLOGICAL SAMPLES. Scales, B. (Imperial Chemical Industries Ltd., Macclesfield, Eng.). pp 211-219 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A report is given of a study undertaken to check the agreement between different methods of sample preparation and different people using the same method for liquid scintillation counting of ^{14}C in urine and plasma. The sample preparation methods used were emulsion counting, solution counting and combustion techniques. A summary of results is given. For each sample there are highly significant differences between methods ($P < 0.005$) and between people using the same method ($P < 0.005$). The particular differences vary from sample to sample. It is considered that the results are very disturbing and are all the more difficult to assess because no absolute standard exists. (UK)

10588 MICELLAR SCINTILLATORS. A Rational Approach to the Design of Stable Assay Solvents for Liquid Scintillation Counting. Ewer, M. J.; Harding, N. G. L. (Postgraduate Medical School, Cambridge, Eng.). pp 220-233 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

In a study undertaken to examine the possibility of producing a solvent having ideal properties for the preparation of samples for liquid scintillation counting the possibility of the use of micellar scintillators has been investigated. Micellogenic molecules as referred to here consist of two regions containing three parts: a hydrophilic region comprised of charged and hydrophilic moieties, and hydrophobic areas built from hydrocarbons. Promising results are reported for counting tritiated water in ternary lecithin micelles but it became apparent that to realize the potential of this approach it would be necessary to examine synthetic micellogenic reagents as replacements for the naturally occurring choline phosphoglyceride used in the first-generation experiments. From these experiments it was deduced that in many situations a terminal cationic charge was particularly useful. Other solvent and sample conditions demanded charge of opposite polarity. A well-defined hydrophilic terminus is obligatory; the type of charge depends upon the samples to be added and the length of the hydrocarbon chain is to some extent dictated by the nature of the sample and the solvent of the organic phase. It is evident that the micellar concept not only provides highly efficient scintillants with good capacity for a wide range of samples, but also offers a useful theoretical approach to the design of functional systems. (UK)

10589 ACTIVITY DETERMINATION OF PHOSPHORUS-32 SOURCES WITH HIGH SOLID CONTENT. Guenther, E. (Physikalisch-Technische Bundesanstalt, Braunschweig, Ger.). pp 234 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A method is described in which liquid scintillation counting using an internal standard was used for the quick, reliable and accurate determination of ^{32}P sources with high solid content. A NaCl probe was used for fast neutron flux density determinations which resulted in samples with a relatively low specific activity of ^{32}P. A mixture of 65% scintillator Insta-Gel and 35% water was used. A standard deviation of between 0.4 and 1% was obtained from which it was assumed that the main source of error beyond counting statistics was the instability and inhomogeneity of the gel. (UK)

10590 CHERENKOV COUNTING AND OTHER SPECIAL TOPICS. Parker, R. P. (Royal Marsden Hospital, Sutton, Eng.). pp 237-252 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

The development of sensitive automatic liquid scintillation counting equipment and the subsequent demand for improvements in sample preparation has encouraged the use of Cherenkov counting for the assay of high-energy β-emitting radioisotopes. The advantages of the method lie in the simplicity and cheapness of sample preparation and the absence of chemical quenching. Workers have experimented with solid and inhomogeneous samples with considerable success. Quench corrections are now being applied with confidence, avoiding the need for decolouration. There have been only a few attempts at routinely measuring β-emitters of less than 1 MeV, but the use of wavelength shifters and high quantum efficiency phototubes should improve the situation. A review of the many applications of the method in radioassay is given. (UK)

10591 CONTINUOUS MEASUREMENT OF ^{14}C ACTIVITY IN CIRCULATING BLOOD BY LIQUID SCINTILLATION COUNTING. Page, B. F. J. (Huntingdon Research Centre, Eng.). pp 273-278 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A method is described of measuring ^{14}C levels in the circulating blood of baboons by liquid scintillation counting. A flow cell was constructed from KL211 polystyrene plastic scintillator in which the U-shaped flow channel was formed so that as large a contact area as possible existed between the blood and the scintillator for events to occur while still presenting the smallest possible area of blood in the field of view of the photomultiplier tubes. The apparatus was calibrated using both water and whole blood and counting efficiency was found to lie between 1.5 and 3%, depending on the individual cell used. The system was used to study the absorption of nicotine by the baboon from various sites. The technique is being developed to study absorption patterns of drugs and uptake of drugs by various organs. (UK)

10592 LIQUID SCINTILLATION COUNTING OF IRON-55 USING AQUASOL. Sutton, G. A.; Harvey, B. R. (Ministry of Agriculture, Fisheries and Food, Lowestoft, Eng.). pp 279-286 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A method of measuring low-level ^{55}Fe in environmental samples using a liquid scintillation spectrometer is described. Ferric hydroxide is dissolved in phosphoric acid, which is then incor-

porated directly into the liquid scintillation cocktail "Aquasol"; considerable quantities of stable iron can be accommodated with little loss of counting efficiency, thus allowing samples of lower specific activity to be measured than would be possible with other methods. Comparisons of counter response versus stable iron content obtained by the present method and that of Eakins and Brown [UKAEA Report No. R4946 (1965)] are given. It can be seen that for the present method a maximum has not been reached at 50 mg of stable iron; however, this is almost the practical limit for stable iron set by the quantities of reagents needed, relative to the volume of the vials. Where the amount of stable iron in a sample is, for other reasons, limited to less than 10 mg, the method of gel scintillation offers the advantage of a lower background (about 5 cpm) and slightly higher efficiency. However, where the specific activity is low and sample size is not a limiting factor, then the present method offers considerable advantages even with a higher background (about 10 cpm). (UK)

10593 IN-VIAL OXIDATION PROCEDURE FOR THE SIMULTANEOUS DETERMINATION OF PLUTONIUM ALPHA-ACTIVITY AND PLUTONIUM-241 ON SMEAR SAMPLES. Eakins, J. D. (United Kingdom Atomic Energy Authority, Harwell, Eng.). pp 287-294 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A rapid method for the determination of ^{241}Pu and plutonium α-activity on smear samples with sufficient accuracy for indirect surface contamination monitoring is described. The plutonium β/α ratio obtained is good enough for the operational health physicist to estimate ^{241}Pu surface contamination from direct α-counting and also to identify the source of the contamination. The method utilizes gel scintillation counting after preparation of the sample "in vial" using ammonium persulfate oxidation. Good separation of plutonium α and β activity was obtained due to the reduction in particle size of the smear residue after oxidation and due to the composition of the inorganic residue remaining after combustion. This contains a high proportion of iron which normal combustion leaves as a brownish oxide producing considerable color quenching. Ammonium persulfate converts this iron to a very pale yellow material, which produces much less quenching. (UK)

10594 BOMB METHOD FOR RAPID COMBUSTION OF SAMPLES. Burleigh, R. (British Museum, London). pp 295-302 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A bomb method and apparatus is described for the preparation of ^{14}C samples by the combustion of organic samples to carbon dioxide. The technique has been used for sample preparation in ^{14}C dating using internal gas and scintillation counting. Samples of up to 20 g in weight can be used and each combustion requires only 20 min of full-time attention by an operator. There is no doubt that the kinds of sample material commonly met in radiocarbon dating are completely burnt in the bomb. Generally little or no ash remains after the combustion and almost all (probably better than 99%) of the carbon dioxide can certainly be recovered. The purity of the gas is high as traces of oxides of nitrogen and sulfur formed during the combustion are mostly dissolved in the small amount of distilled water deliberately placed in the bomb for this purpose before firing. (UK)

10595 MICROMETHOD FOR UREASE. De Bersaques, J. (Univ., Ghent). pp 303-306 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

Various techniques, which have been reported for the determination of urease activity by measurement of the $^{14}CO_2$ set free from ^{14}C labelled urea, are considered. In the experiments reported here small throw-away tubes were made from 5-mm-ID borosilicate glass tubing and siliconized. The reaction mixture, 10 μl with 20 mM urea, 40 mM pH 7.0 Tris-HCl buffer, 70,000 cpm ^{14}C-urea and urease, was present at the bottom of the tube. A 5-μl drop of 1 N sulfuric acid was placed on the side wall. The 30 μl liquid seal was put in a separate piece of glass tubing, linked to the reaction tube by a short length of latex tubing. This two-piece construction was adopted in order to avoid contamination of the seal by the radioactive solution. A glass stopper was placed at the other end of the second tube. The tubes could be incubated horizontally on the bottom of a water bath. After the chosen incubation period, the acid was tipped into the reaction mixture to destroy the enzyme and liberate $^{14}CO_2$. After a suitable volatilization period, the latex tubes were removed and the glass tube with the alkaline seal was dropped into a counting vial with scintillator and counted at room temperature. The total CO_2 was very small; 0.2 μmole at 100% hydrolysis. The efficiency was measured as 75%. The time needed to capture quantitatively the $^{14}CO_2$ released by the acid was less than 10 min. The radioactivity measured was proportional with time and amount of enzyme, up to about 20% hydrolysis of the substrate. The sensitivity of the method was such that 2×10^{-6} Sumner units gave 1000 cpm after 1 h incubation at 37°C. (UK)

10596 ANALYSIS OF AIR PARTICULATES BY RADIOISOTOPE X-RAY FLUORESCENCE FOR AIR POLLUTION CONTROL. Florkowski, T.; Piorek, S. (Inst. of Physics and Nuclear Techniques, Krakow). Nukleonika; 19: No. 10, 891-898(1974).

The x-ray fluorescence method for analysis of particulates in air is described. Samples are collected on filter paper by pumping through it 10 to 400 m^3 of air. Measurement equipment consists of Si/Li detector and multichannel analyzer. Excitation of characteristic K or L x rays is performed with radioisotope sources ^{241}Am, ^{238}Pu, ^{109}Cd and ^{55}Fe. Spectra of the x-rays are shown and results of analysis of samples collected in 1973 are given. Three elements Fe, Zn and Pb are determined in the concentration range of 0.01 to 18 μg/m^3. (auth)

10597 RAPID CONTROL ASSAYS BY RADIOISOTOPE X-RAY TECHNIQUES. Wenk, G. J.; Wilkinson, L. R. AMDEL (Aust. Miner. Develop. Lab.) Bull.; No. 17, 1-16(Apr 1974).

Rapid-analysis instruments based on radioisotope x-ray techniques, were produced by Amdel for use in mining and metallurgical processing. They were used for assaying metals in several mineral products for grade and process control during pilot-plant or full-scale operations. Assays for tin, tungsten, lead, zinc, and iron are reported. (auth)

10598 ESTIMATION OF THORIUM USING CALCIUM-45. Ray, M. N.; Chacharkar, M. P. (Nagpur Univ., India). pp 119-124 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A method for the estimation of Th is presented. It is based on the fractional precipitation of Th as the oxalate using ^{45}Ca as a tracer in the presence of Ca ions. The activity of the precipitate is measured with a G-M counter. The experimental results showed that the method provides a reproducible precise equivalent point in good agreement with the theoretical values. Solubility products for the Th and Ca oxalates suggest that in a mixture containing both ions, Th oxalate will precipitate first. (JSR)

10599 SHORT PROCEDURE FOR ESTIMATION OF ^{99m}Tc, ^{239}Np AND RADIOIODINES IN BWR COOLANT. Nandwani, T. B.; Joshi, N. B. (Tarapur Atomic Power Station, India). pp 231-236 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A rapid procedure for the evaluation of ^{99m}Tc, ^{239}Np, and radioiodines in BWR coolants is presented. The Np is precipitated quantitatively by ferric hydroxide, the precipitate is washed, dried, and counted with a multichannel analyzer. The iodine is removed from the supernate by adsorption on an AgCl column. The effluent and column washings are then treated to coprecipitate Tc with CuS. The iodine is counted in the column. The CuS precipitate with the Tc is counted using a NaI(Tl) 512-channel analyzer system. The procedure is effective only when Tc is present in the heptavalent state and iodine in the I$^-$ form. Procedures for ensuring these chemical states are given. Gamma spectra of the separated fractions indicate that the energy peaks are clear and have no interference from other nuclides present. (JSR)

10600 TRITIUM CONCENTRATIONS IN ENVIRONMENTAL WATER SAMPLES OF NORTH TAIWAN REACTOR SITES. Huang, J. F. (National Tsing Hua Univ., Hsinchu, Taiwan); Weng, P. S.; Tsai, C. M. Nucl. Sci. J. (Taiwan); 11: No. 3, 122-126(Sep 1974).

The study of the electrolytic enrichment of tritium in water is reported in this work. With the initial and final sample volume set to be 200 cm^3 and 10 cm^3 respectively and the sample was added into the electrolysis cell periodically, the enrichment has been determined to be 15.38 ± 1.14. The enrichment may improve the detection limit of the present counting system from 1.65 pCi/cm^3 to 0.11 pCi/cm^3. (auth)

10601 DETERMINATION OF RADIONUCLIDES IN TAIWAN RESEARCH REACTOR PRIMARY COOLING WATER. I. Chou, C. C.; Chang, F. C.; Pung, T. C.; Tsai, H. T. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Nucl. Sci. J. (Taiwan); 11: No. 3, 154-159(Sep 1974). (In Chinese).

Ge(Li) gamma-ray spectrometry has been used for the measurement of radionuclides in primary cooling water. The fundamental relationship of radioactivities to the operation time, and to the power of reactor were investigated. In these preliminary results we found radionuclides such as ^{13}N, ^{27}Mg, ^{64}Cu, ^{56}Mn, ^{24}Na in primary cooling water. (auth)

10602 DETERMINATION OF RADIONUCLIDES IN TAIWAN RESEARCH REACTOR PRIMARY COOLING WATER. II. Chou, C. C.; Chang, F. C.; Pung, T. C.; Tsai, H. T. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Nucl. Sci. J. (Taiwan); 11: No. 3, 160-165(Sep 1974). (In Chinese).

Gamma-ray spectrometry with a high resolution Ge(Li) detector was used to measure the radionuclides in the primary cooling water of the reactor. Chemical separations were performed to separate the radioiodine and radioxenon from fission products. The fundamental relationships of radioactivities of ^{131}I, ^{133}I and ^{239}Np to the reactor operation time were investigated. (auth)

10603 DETERMINATION OF THE CONCENTRATION OF CHEMICAL SOLUTIONS IN FABRICATION PROCESSES BY THE BACKSCATTERING OF β^- RADIATIONS. Marcu, G.; Sacelean, V. Stud. Univ. Babes-Bolyai, Ser. Chem.; 19: No. 1, 97-101(1974). (In French).

From 24th congress of international pure and applied chemistry; Hamburg, Ger. (2 Sep 1973).

The use of β^- backscattering for the determination of the concentration of chemical solutions was studied. It was concluded that there is a linear dependence between the concentration of the solutions and the intensity of the back-scattered β^- radiation only in a limited region. The intensity of the back-scattered β^- radiation varies linearly with the effective atomic number of the solutions but undergoes an abrupt break at the level of rare gases. A linear dependence exists between the intensity of the back-scattered β^- radiation and the back-scattering factor of the solution to be analyzed for all concentrations of the solution. (tr-auth)

10604 DETERMINATION OF NATURAL RADIONUCLIDES IN REGOLITH SAMPLE FROM LUNA-16. Tykva, R. (Inst. of Organic Chemistry and Biochemistry, Prague). Geokhimiya; No. 10, 1573-1574(Oct 1974). (In Russian).

The concentration of ^{26}Al, ^{22}Na, and ^{40}K in small samples of lunar material was determined by non-destructive γ spectrometry using a Ge(Li) detector. The results are given in decays/min in a 1-kg sample and the total K is given in wt %. The values for the total K agree well with values obtained using mass spectrometry. (JSR)

10605 QUANTITATIVE DETERMINATION OF FISSION PRODUCTS IN IRRADIATED FUEL PINS USING NONDESTRUCTIVE GAMMA SCANNING. Phillips, J. R.; Waterbury, G. R.; Vanderborgh, N. E.; Marshall, T. K. (Los Alamos Scientific Lab., NM). Anal. Chem.; 47: No. 1, 71-75(Jan 1975).

A computer-controlled gamma scanning system was applied to the nondestructive determination of fission products in irradiated uranium–plutonium carbide and oxide fuel pins. The quantitative determinations were made possible by a detailed calibration of the gamma scanning system including: measurement of the effective collimating slit, detector surface response functions, and the development of a computer code for simulation of various source geometries. Following the nondestructive gamma scanning examinations of the irradiated fuel materials, the samples were dissolved remotely, and analyzed independently by well-proven radiochemical methods. The gamma scanning results differed by an average of 3.2 and 3.7% for three fission products (^{106}Ru–^{106}Rh, ^{137}Cs, and ^{144}Ce–^{144}Pr) in three (U,Pu) carbide samples and three UO_2–PuO_2 samples, respectively. These data indicate that precision gamma scanning can be applied to the nondestructive determination of fission products in irradiated (U,Pu) carbide and oxide fuel pins. (auth)

10606 ANALYSIS OF SURFACE COMPOSITION BY ION SCATTERING SPECTROMETRY. Wheeler, M. A. (Ford Motor Co., Dearborn, MD). Anal. Chem.; 47: No. 1, 146-148(Jan 1975).

A method for extracting quantitative information from ion scattering spectrometry data is described. Elemental sensitivity is a function of atomic number with the greatest sensitivity existing for elements of highest atomic number. (auth)

10607 ON-LINE QUANTITATIVE GAMMA SPECTROMETRY WITH COMPUTERIZED DATA REDUCTION. Olson, D. G. (Atomic Energy Commission, Idaho Falls, ID); Cole, M. S. Anal. Chem.; 47: No. 1, 75-79(Jan 1975).

An on-line computer-based method for alpha and gamma spectrometry is presented. Because the entire program is operable on a PDP/8 computer with 8K of memory, the laboratory which requires rapid results but has only a modest budget will be most interested. The vital part of the program is a routine to automatically find, statistically evaluate, and print out the data about each photopeak without having to specify the peak locations. A plotting package, smooth routine, and other data-handling operations are included. DEC-tape may be used for program and data storage but is not a necessary piece of equipment. (auth)

10608 RAPID RADIO-TRACER TECHNIQUE OF PHOSPHATE ESTIMATION. Das, S. K.; Santikari, A. K.; Upadhyay, S. R.; Banerji, K. C. (Fertilizer Corp. of India Ltd., Sindri). Technology (Sindri); 10: No. 3-4, 182-185(1973).

A radiotracer technique has been developed for rapid and accurate estimation of phosphate in rock phosphate and phosphatic fertilizer samples. The method involves precipitation of phosphate as ammonium phosphomolybdate using excess amount of ^{99}Mo tagged standard ammonium molybdate as the precipitant. The precipitate is separated by filtration and the unused activity accompanying the filtrate is assayed by counting a suitable aliquot in a well scintillation counter. The difference of the total activity added and that remaining in the filtrate readily gives the amount of ammonium molybdate consumed in precipitation and hence the phosphate content of the sample. The present method combines accuracy and wide concentration-range applicability with speed—a feature unknown in any single procedure for phosphate estimation reported so far. A large number of samples with known as well as unknown phosphate contents have been analyzed and the results compare very favorably with simultaneously carried out gravimetric analyses. (auth)

10609 DETERMINATION OF NATURAL TRITIUM CONCENTRATION IN ENVIRONMENTAL SAMPLES. Biro, T.; Pavlicsek, I.; Rakvacsne, S. O.; Szarvas, T. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 493-497(1974). (In Hungarian).

Enrichment of tritium was accomplished by electrolysis (with an enrichment factor of 15 in a single step). Activity measurement was made with liquid scintillation spectrometer. (auth)

10610 COMBUSTION METHOD APPARATUS FOR PREPARING SAMPLES FOR LIQUID SCINTILLATION COUNTING. Noakes, J. E. (to Nuclear-Chicago Corp.). US Patent 3,844,716. 29 Oct 1974. Filed Date 1 Dec 1971. 6p.

Many different methods of combustion have been used to produce oxidation products of ^{14}C, ^{35}S, or ^{3}H compounds. However, the oxygen flask combustion technique developed by W. Schoniger is preferred. An improvement of the Schoniger technique is provided herein making lower combustion temperatures possible. Ignition of the sample is maintained without the addition of foreign combustible material of nonsample origin by means of a high intensity continuous spark and the resulting formation of reactive ozone and singlet oxygen. (Official Gazette)

Separation Procedures

10611 (AEC-tr-7422/7) NUKLEONIKA. Translation of Nukleonika; 18: No. 7, 277-332(1973). 52p. (TT-73-54035/7). Dep. NTIS $5.45.

10612 (CONF-741002-P2, pp 866-876) IS TERBIUM AT TRACE CONCENTRATIONS PARTIALLY STABILIZED IN THE QUADRIPOSITIVE STATE IN SOLVENT EXTRACTION? Alstad, J.; Farbu, L. (Univ. of Oslo). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

This study has shown that in extraction of rare earths at specified conditions not only Ce but also Tb behaves to some extent as if it were a partially quadripositive ion. As no irregularity was observed in extraction of Tb with HDEHP from H_2SO_4 solutions, an experiment was performed whereby ozone was brought into the system in order to oxidize Tb^{3+}. But any effect of ozone on the distribution of Tb was not achieved. Further experiments are, however, in progress to state more specifically those conditions which lead to the observed irregularities in the distributions. In discussing tetrad effects, Jørgensen pointed out that irregularities may be introduced if the lower the $4f^{q-1}5d$– $4f^q$ energy difference is, the stronger the covalent bonding. According to deduced values of this energy for gaseous Ln^{3+} the covalent bond contribution order would be: Ce > Tb > Pr > Dy ..., but any singularities for Ce and Tb do not seem reasonable as the excitation energy increases monotonically in the given order. (auth)

10613 (INIS-mf-1573) SEPARATION OF INDIVIDUAL RARE EARTH ELEMENTS BY ASSOCIATION OF HOMOGENEOUS PRECIPITATION AND ION EXCHANGE TECHNIQUES. Umeda, K. (Sao Paulo Univ. (Brazil). Escola Politecnica). 1973. 90p. (In Portuguese). INIS.

Thesis.

This work was developed at the Atomic Energy Institute's Chem-

ical Engineering Department, by associating both fractional homogeneous precipitation and ion exchange techniques for the separation of Ce, Nd, Pr, Sm, and La as individual rare earths from their mixed chlorides supplied by Administracão da Producão da Monazita, São Paulo. Cerium was first separated from Nd, Pr, Sm, La and other yttrium group rare earths by precipitation of Ce(IV) hydroxide with urea and hydrogen peroxide as oxidant. The same technique but without hydrogen peroxide was used for the enrichment of Nd, Pr, and Sm in subsequent precipitations; La was kept in the last filtrate. Experimental results showed that the precipitation is very efficient since the urea hydrolysis is easily controlled, allowing the elimination of practically all cerium and about all lanthanum, both elements being the major components of the monazite; their separation making easy later fractionation on ion exchange columns. The separation of individual Nd, Pr, Sm, and La was made by two exchange (Dowex-50 W, X-8) columns, Cu^{2+} as retaining ion and EDTA-NH_4 solution buffered with acetic acid as eluent. The application of this technique has made possible the separation of individual rare earths, avoiding the precipitation inside the columns owing to acidity changes. Copper was recovered by precipitation of Cu_2S through thiourea hydrolysis in the Cu-EDTA complex solutions. The associated techniques allowed the obtention of Nd, Pr, and La fractions approximately 99% pure and cerium about 95% pure. (INIS)

10614 (JINR-E12-7744) RAPID ELECTRODEPOSITION OF RADIOACTIVE RARE EARTH. Baier, G. Yu.; Herrmann, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 9p. (In Russian). INIS.

The optimum conditions for the rapid electrodeposition of radioactive carrier-free rare earth elements on W were determined. Optimum efficiency is reached after 30 sec at a current density of 0.2 amp/cm^2 from 2×10^{-3}M solutions of ammonium a-oxyisobutyrate. (tr-auth)

10615 APPLICATION OF THE THEORY OF CHROMATOGRAPHY IN THE CALCULATION OF THE COMPOSITION OF THE AQUEOUS AND RESIN PHASES IN THE ELUTION OF LANTHANIDES BY DIETHYLENETRIAMINEPENTA-ACETATE. I. Effect of the Atomic Number of the Lanthanide and the Concentration and pH of the Eluent. Nazarov, P. P.; Sheptunov, V. N.; Maslova, G. B.; Chmutov, K. V. (Inst. of Physical Chemistry, Moscow). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 2, 232-233(Feb 1974).

Translated from Zh. Fiz. Khim.; 48: No. 2, 400-402(Feb 1974).

The composition of the lanthanide band in the elution of macroamounts of lanthanides by diethylenetriaminepentaacetate was calculated on the basis of the theory of equilibrium complex-formation chromatography. The influence of the atomic number of the lanthanide and the pH and concentration of the eluent on the phase composition and the conditions governing the elution of the lanthanides were elucidated. The calculated and experimental compositions are in satisfactory agreement. (auth)

10616 BEHAVIOR OF Mo(VI) ON HIGHLY BASIC ANION EXCHANGER. Vasilenko, L. V.; Kazantsev, E. I. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 7-77(1974). (In Russian).

Dynamic studies with anion exchanger AV-17 showed that Mo can be detected and the state of the sorbed Mo ion determined from the average specific charge on the ions. Data obtained agreed with literature data on the state of Mo(VI) ions in aqueous solution. The complexity of the sorbed Mo ions in the resin phase explains some problems of its behavior on an anion exchanger. (MG)

10617 ION EXCHANGE SEPARATION OF Zr FROM OTHER ELEMENTS. Kudryavskii, Yu. P.; Kazantsev, E. I.; Bazin, Yu. A.; Onosov, V. N. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 97-99(1974). (In Russian).

Zr was separated from Ce(III), Cu, and Ni, under static conditions on the cation exchanger KF-7. Sorption was from sulfuric acid solution, and elution with xalic or hyodrofluoric acid Zr and Al were separated on the cation exchanger KFP-8, with sorption from hydrochloric acid solution and elution by ommonium fluoride. (MG)

10618 DISTRIBUTION OF RARE EARTHS IN EXTRACTION WITH CARBOXYLIC ACIDS. Danilov, N. A.; Korpusov, G. V.; Krylov, Yu. S.; Korpusova, R. D.; Tsygankova, G. V. (Inst. of Physical Chemistry, Moscow). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 102-108(1974). (In Russian).

The presence of a hydrocarbon radical in the α position of a carboxylic acid increases the selectivity of rare earth extraction. A hydrocarbon further removed from the carboxyl group and the degree of branching do not affect the selectivity. In systems with α, α'-dialkyl carboxylic acids, Y occupies a constant position in the rare earth series (between Gd and Tb) for a wide range of rare earth concentrations and is salted out, unlike the falty acids and isoacids, where the Y position depends on the aqueous phase concentration. α, α'-dialkyl carboxylic acids do not cause inversion of the distribution coefficients in the absence of salting out agents. (tr-auth)

10619 EXTRACTION OF LACTIC ACID BY D2EHPA IN THE PRESENCE OF Nd. Nikolaev, V. M.; Lebedev, V. M.; Detkina, N. A. Zh. Neorg. Khim.; 19: No. 7, 1914-1918(Jul 1974). (In Russian).

The effects were studied of 02EHPA [bis(2-ethylhexyl) phosphonic acid] concentration, the degree of its saturation with Nd, and the lactic acid concentration of the solution on the mole ratio of the lactate ion to the metal ion in the organic phase in the extraction of Nd by D2EHPA from lactic acid solution. (tr-auth)

10620 SORPTION OF SOME IONS FROM ACID SOLUTIONS BY HYDROUS ZIRCONIA. Sakellaridis, P. U.; Nobelis, F. Z. (National Technical Univ., Athens). J. Inorg. Nucl. Chem.; 36: No. 11, 2599-2603(Nov 1974).

The study of the pH-dependent uptake of some ions of alkali, alkaline earth and transition metals on hydrous zirconium oxide establishes that the phenomenon depends not only upon the ionization constant for the hydroxyl group of sorbent but also upon the readiness with which the cation associates with the oxygen in the matrix. The simultaneous sorption of the anion and the estimation of the solution final pH prove that the anion is not sorbed only through the mechanism of ion exchange. On the basis of the experimental data for the sorption of ions by hydrous zirconia, a mechanism is proposed. I. R. spectral evidence suggests that the sorption of cations from acid solutions is accomplished through the surface hydroxyls of hydrous zirconia. The existence of many types of hydroxyl groups is also proved, suggesting that the exchange sites of the sorbent may be heterogeneous. (auth)

10621 MICROCHROMATOGRAPHIC SEPARATION OF RARE EARTH ELEMENTS. Molnar, F.; Horvath, A.; Khaikin, V. A. (Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete, Budapest). Magy. Kem. Foly.; 80: No. 10-11, 474-481(1974). (In Hungarian).

The optimum conditions for the microchromatographic separation of rare earth elements were investigated in anion exchanger-aqueous-methanolic ammonium nitrate systems. The gradient elution technique was used. The mixing system, suitable for the realization of the optimum concentration gradient, was established and its parameters were calculated. The movement of the adsorbate peaks downwards the column was investigated and a simple relationship was deduced for the calculation of elution peak locations. A method was described for fast and precise determination of distribution coefficients by means of the gradient elution technique. (auth)

10622 SEPARATION OF ^{210}Po(RaF) BY EXTRACTION WITH DI(2-ETHYLHEXYL)PHOSPHORIC ACID. Zsoldos, T.; Molnar, L.; Filus, K. Magy. Kem. Foly.; 80: No. 9, 416-419(Sep 1974). (In Hungarian).

A new separation method for ^{210}Po is described using a mixture of di(2-ethylhexyl)phosphoric acid and light petroleum for the extraction of ^{210}Po. The dependence of the distribution coefficient of the hydrogen ion and extracting agent concentrations has been measured. Applying 12 N HCl as a reextracting agent the degree of efficiency of the method is 0.91 ± 0.021. (auth)

10623 200 SISAK: A NEW TECHNIQUE FOR RAPID, CONTINUOUS (RADIO)CHEMICAL SEPARATIONS. Aronsson, P. O.; Johansson, B. E.; Rydberg, J. (Chalmers Tekniska Hoegskola, Goteborg). J. Inorg. Nucl. Chem.; 36: No. 11, 2397-2403(Nov 1974).

SISAK, a new continuous technique for on-line chemical separation of short-lived species, is presented. The system features multistage two-phase liquid-liquid and liquid-solid separations completed within 3 to 5 sec per stage. The system is easily adaptable for selective isolation of almost all elements. The operational characteristics of the system are outlined and the delay properties briefly discussed. A two-detector delay method for half-life determinations is also presented. The application of the technique to the study of short-lived nuclides is exemplified by results from investigations of 30-sec ^{68g}Cu, 3.8-min ^{68m}Cu, and 42-sec ^{70}Cu. (auth)

10624 STUDIES ON INORGANIC EXCHANGERS FOR RADIOISOTOPE SEPARATION. Murthy, T. S. (Bhabha Atomic Research Centre, Bombay). pp 201-208 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The capacities of zirconium phosphate, ammonium phosphotungstate, zirconium antimonate, manganese dioxide, and polyantimonic acid as ion exchangers for the separation of the radioisotopes of Cs, Sr, Ce, other rare earths, Zr, Na, and Ag were studied. The distribution ratios and the break-through capacities were determined. The results showed that only Cs and Zr show high distribution ratios for zirconium phosphate. For ammonium phosphotungstate only Cs had a good distribution value. Zirconium antimonate took up almost all fission product elements at lower acidities, but between 2 and 6M only Sr, Zr, and Na were taken up. For manganese dioxide only Ce, Zr, and Cs showed high distribution between 2 and 4M. Sr can be taken up preferentially on Polyantimonic acid after the initial separation of Zr, Cs, Ce, and Na. The break-through capacities were reasonably good suggesting the feasibility of separation. (JSR)

10625 SEPARATION OF STRONTIUM-90 FROM FISSION PRODUCT SOLUTIONS USING POLYANTIMONIC ACID. Murthy, T. S.; Balasubramanian, K. R.; Ramani, K. S.; Varma, R. N. (Bhabha Atomic Research Centre, Bombay). pp 217-223 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The absorption and elution behavior of Sr from fission product solutions on polyantimonic acid ion exchange columns was studied. The results showed that the breakthrough capacities for Sr from pure HNO_3 solutions free from Na are about 2.25 to 3.0 mg/g. The presence of Na completely inhibits the uptake of Sr. Elution studies at room temperature and 75°C showed that only $AgNO_3 + HNO_3$, and $NaNO_3 + HNO_3$ to a limited extent, had any effect on the adsorbed Sr. The percentage elution of Sr was dependent on the HNO_3 concentration with optimum elution of ~98% Sr achieved at eluent composition of 1M $AgNO_3$ + 8M HNO_3. Elution became difficult if the column loaded with Sr was stored for a time. (JSR)

10626 SEPARATION OF CESIUM-137 FROM FISSION PRODUCT SOLUTION WITH AMMONIUM PHOSPHOTUNGSTATE. Murthy, T. S.; Balasubramaniam, K. R.; Ananthakrishnan, M.; Ramani, K. S.; Mathai, D. (Bhabha Atomic Research Centre, Bombay). pp 225-230 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The adsorption and elution behavior of Cs on ammonium phosphotungstate was studied. The break-through curves from pure HNO_3 and simulated fission product solutions were sigmoid and the breakthrough capacities were less than the overall capacities and were not affected to any extent by the presence of large amounts of other ions. The elution behavior was studied with ammonium chloride, ammonium acetate, and ammonium nitrate solutions of varying concentrations. Ammonium chloride did not elute Cs. Ammonium acetate at 2M and 4M eluted satisfactorily but attacked the column. Ammonium nitrate at 6 to 10M eluted Cs with an overall yield of 85 to 90%. (JSR)

10627 INVESTIGATION OF THE SUBSTOICHIOMETRIC EXTRACTION OF 14 METALS FROM SULFURIC, HYDROCHLORIC, AND PERCHLORIC ACIDS WITH ZINC-DIETHYLDITHIOCARBAMATE BY RADIOMETRIC EXTRACTIVE TITRATION. Wyttenbach, A.; Bajo, S. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). Anal. Chem.; 47: No. 1, 2-7(Jan 1975).

The order found for successive extractions is Au^{3+}, Hg^{2+}, Tl^{3+}, Ag^{1+}, Cu^{2+}, Bi^{3+}, Sb^{3+}, Te^{4+}, Mo^{6+}, Se^{4+}, In^{3+}, As^{3+}, Pb^{2+}, Cd^{2+}. In all cases, except Au^{3+} and Mo^{6+}, the number of diethyldithiocarbamate (DDC) ligands attached to the extracted complex is equal to the valency of the metal. Non-extractable precipitations are formed by Ag^{1+} and Hg^{2+}. From Cl-containing solutions, two complexes with the stoichiometry $MeDDC_n$ and $MeDDC_{n-1}$ are extracted where Me = Hg^{2+}, As^{3+}, Sb^{3+}, Bi^{3+}, or Te^{4+}; their exchange constant was determined and their electronic spectra were measured. Extraction is complete within 15 sec., except for Mo^{6+}, Se^{4+}, Te^{4+}, In^{3+}, and As^{3+}; these metals have a half-time of extraction of the order of 1 minute. In many instances, replacement reactions involving MeDDC are much slower than extractions with $Zn(DDC)_2$. Possible analytical applications are discussed. (auth)

10628 EXTRACTION OF URANYL SULFATE BY MIXTURES OF URANYL DI-2-ETHYLHEXYLPHOSPHATE AND TRIBUTYL PHOSPHATE. Mikhajlov, V. A.; Torgov, V. G.; Us, T. V. (An SSSR, Novosibirsk. Inst. Neorganicheskoj Khimii). Dokl. Akad. Nauk SSSR; 214: No. 5, 1121-1123(11 Feb 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

The extraction of UO_2SO_4 from its aqueous solutions by mixtures uranyl bis(2-ethylhexyl phosphate) (UO_2R_2) and TBP was studied. The UO_2SO_4 extracted with this mixture completely passes into the aqueous phase during treatment of the extract with water. The extraction mechanism was examined. It was shown that one link of the polymer chain $(UO_2R_2)_p$ can be occupied either by two molecules of TBP or one molecule of TBP and one molecule of UO_2SO_4, which in turn is solvated by one TBP molecule. The extraction of UO_2SO_4 by uranyl di-2-ethylhexylphosphate in the presence of TBP is explained by the acceptor properties of the U atom in $(UO_2R_2)_p$. (tr-auth)

10629 CATION EXCHANGE DISTRIBUTION COEFFICIENTS OF ELEMENTS IN HYDROCHLORIC ACID-ACETONE SOLUTIONS AND THEIR APPLICATION TO THE SEPARATION OF ELEMENTS. Victor, R. H. (Pretoria Univ. (South Africa)). 1973. 116p. INIS.

Copies available from Pretoria Univ., Pretoria (South Africa).

Cation exchange distribution coefficients were determined for 54 elements in hydrochloric acid solutions containing acetone, varying from 0.1 to 0.6 M and 0 to 95% respectively, using sulfonated polystyrene cation exchanger AG50W-X8. The cation exchange behavior of elements in hydrochloric acid–acetone media were discussed and a number of possible separations were proposed. How the information of the values of distribution coefficients obtained during this systematic survey, can be used to separate the elements in multicomponent mixtures was illustrated. For this, three elution curves were prepared which demonstrate the separation of: (i) cadmium, zinc, iron (III), copper (II), cobalt (II), and manganese (II); (ii) thallium (III), indium, gallium, aluminium, and ytterbium; and (iii) vanadium (V), iron (III), uranium (VI), titanium (IV), calcium, and barium. In addition, the quantitative aspects of the selective separation of magnesium (II) and copper (II) from other elements were investigated in detail. The hydrochloric acid–acetone system was also applied to the separation of elements with small differences in their chemical properties as in the case of group IIIA elements, by means of cation exchange chromatography. Excellent results were obtained for the analysis of synthetic mixtures containing aluminium, gallium, indium, and thallium (III). An additional anion exchange separation procedure was used to separate gallium from acetone solutions, because it was observed that small amounts of gallium were volatilized when solutions containing hydrochloric acid and acetone were evaporated on the water bath. Results of this survey were published recently. [F. W. E. Strelow and A. H. Victor, Talanta 19, 1019 (1972)]. Finally an improved elution scheme was elaborated by which the silicated elements, sodium, potassium, magnesium, manganese, calcium, aluminium, iron, titanium, vanadium, and zirconium can be separated from each other by means of a single column operation. (INIS)

Inorganic, Organic, and Physical Chemistry

Refer also to abstract 13481.

Chemical and Physicochemical Properties

Refer also to abstracts 11763, 11775–11778, 11784, 11807, 11808, 11818, 11819, 11833, 11834, 11845, 11849, 11858, 11885, 11960–11963, 12006, 12096, 12101, 13401, 13402, 13487, and 13488.

10630 (BARC-707) LABORATORY INVESTIGATIONS ON THE USE OF AQUEOUS HYDRAZINE AS DISSOLVED OXYGEN SCAVENGER. Natarajan, K.; Vishwanathan, N.; Mathur, P. K.; Subramanian, C. K. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

Investigations have been carried out on the use of hydrazine hydrate as oxygen scavenger to eliminate dissolved oxygen from demineralized water to be used in various loops of Reactor Engineering Division. Rate of the reaction between hydrazine and dissolved oxygen has been studied by taking various initial dissolved oxygen concentrations and different excess amounts of hydrazine. Various aspects of this reaction have been discussed and it has been concluded that aqueous hydrazine can be successfully used as an oxygen scavenger, provided it is added in sufficient excess and sufficient time is allowed for the completion of the reaction. (auth)

10631 (CEA-Bib-213) OXIDES OF RUTHENIUM AND TRAPPING OF THE VOLATILE COMPOUNDS OF RUTHENIUM. Courtois, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Div. de Chimie). Nov 1974. 39p. (In French). Dep. NTIS (US Sales Only) $5.00.

The oxides of ruthenium and the various materials used for trapping the volatile compounds of ruthenium are reviewed. These results are listed in order to understand the behavior of ruthenium in a fluoride volatility process. (auth)

10632 (CONF-741002-P2, pp 495-501) LANTHANIDE COMPLEXES DERIVED FROM LIGANDS WITH NON-OXYGEN DONOR GROUPS. Moeller, T. (Arizona State Univ., Tempe). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

It is proposed in this discussion to explore some facets of coordination by atoms other than oxygen, to discuss a limited number of non-oxygen-donor systems, and to refer to pertinent presentations scheduled for the current conference. (auth)

10633 (CONF-741002-P2, pp 511-518) INFRARED ABSORPTION SPECTRA OF NEODYMIUM AND PRASEODYMIUM CHLOROBENZOIC ACID COMPLEXES. Tandon, S. P.; Vaishnava, P. P. (Univ., Jodhpur, India). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Infrared absorption spectra of Pr^{3+} and Nd^{3+} complexes of o-chlorobenzoic acid are reported. The results are discussed in the light of the theoretically calculated different modes of vibration, and an attempt was made to investigate the nature of metal–oxygen bonding in the complexes. (LK)

10634 (CONF-741002-P2, pp 519-527) MAGNETOCHEMISTRY OF OCTAHEDRALLY COORDINATED TRIVALENT LANTHANIDES. Kanellakopulos, B. (Kernforschungszentrum, Karlsruhe, Ger.); Aderhold, C.; Moeller, T.; Dieck, R. L. 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Physicochemical studies of organometallic rare earth compounds in general yield the evidence of a stronger interaction between central ion and ligand field compared to that found in the so-called rare earth salts. The stronger influence of organic ligands can be due either to (1) direct transfer of ligand electrons into unfilled 4f-orbitals or (2) donation into the empty 5d, 6s and 6p orbitals of the triply ionized lanthanides. Results from magnetochemical studies are presented. (auth)

10635 (CONF-741002-P2, pp 528-537) METAL-LIGAND EQUILIBRIA IN CHELATION REACTIONS BETWEEN RARE EARTH IONS AND SOME AZO DYES. Dey, A. K.; Nayan, R. (Univ., Allahabad, India). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Chelation reactions between azo dyes [1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid and p-nitro benzeneazochromotropic acid] and rare earth ions [Y(III), La(III), Pr(III), Nd(III), Sm(III), Eu(III), Gd(III), Tb(III), Dg(III), Ho(III), Er(III), Tm(III), Yb(III), and Lu(III)] were studied. (LK)

10636 (CONF-741002-P2, pp 588-592) HYDROUS OXIDE COMPOSITIONS OF RARE EARTH (III) CATIONS AND MIXED VALENCE CHROMIUM (III), (V), (VI). Onstott, E. I.; Heaton, R. C. (Los Alamos Scientific Lab., NM). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Hydrous oxide compositions containing rare earth (III) cations and chromium (III), (V), and (VI) were prepared by reaction of chromate (VI) with a deficiency of reducing agent under hydrolysis conditions at ~293°K. Valence states were identified by absorption spectra, oxidizing titer, RE/Cr ratios and thermogravimetric measurements. $EuCrO_4 \cdot 0.08\ EuCr_2O_7 \cdot 0.55\ CrCrO_4 \cdot 7.5\ H_2O$ was prepared by reaction of $EuCl_2$ with K_2CrO_4 plus $K_2Cr_2O_7$ at pH 5.1. $EuCrO_4 \cdot 2.02\ EuCr_2O_7 \cdot 0.70\ CrCrO_4 \cdot 4.6\ H_2O$ was prepared by reaction of $EuCl_3$ and KI with K_2CrO_4 plus $K_2Cr_2O_7$ at pH 5.1. $GdCrO_4 \cdot 0.09\ CrCrO_4 \cdot 0.04\ Cr(OH)_3 \cdot 6.9\ H_2O$ was prepared by anodic oxidation of Gd metal in the presence of $K_2Cr_2O_7$ at hydrogen ion concentrations resulting from hydrolysis and electrolysis. Hydrous oxide precipitates were gelatinous and dark brown in color and difficult to filter. Some hydrolysis took place on washing with water. Air-dried and freeze-dried samples gave no x-ray pattern. Thermogravimetric measurements indicated thermal stability in air to >650°K <950°K, as shown by weight loss with corresponding change in color from dark brown to almost black to light green. (auth)

10637 (CONF-741002-P2, pp 877-883) SHOULD SCANDIUM BE CLASSIFIED WITH THE RARE EARTHS. Melson, G. A. (Michigan State Univ., East Lansing). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Scandium bears a close relationship to the rare earths due to similarities in electronic configuration and predominant oxidation state. The scandium(III) ion does not possess any electrons in d orbitals which may be affected by ligand fields and the 4f electrons of the lanthanides are shielded from the ligand field by the $5s^25p^6$ electrons. Thus the ions of all these elements exhibit uniform charge distribution and the major differences in their chemistries are related to differences in their sizes. Steric interactions between ligands can be correlated with the size of the metal ion involved—a decrease in size giving rise to a lowering of the coordination number. The smaller ions will induce a greater degree of covalency and larger thermodynamic stability into a metal–ligand bond. All these effects have been noted in comparisons between scandium and the rare earths. (auth)

10638 (UCLA-34P88-35) INTRA- AND INTER-MOLECULAR ENERGY TRANSFER STUDIES. Progress Report, 1 June 1973–31 May 1974. Nicol, M. F. (California Univ., Los Angeles (USA). Dept. of Chemistry). 15 Jul 1974. Contract AT(04-3)-34. 33p. Dep. NTIS $4.75.

Studies in progress include analysis of pressure-induced effects on the low-energy triplet states of anthracene in dilute solutions. Determination of the influence of hydrogen-bonding on the intersystem crossing rate and phosphorescence of azines, testing of the time-resolved high-pressure spectrofluorimeter, experimental and theoretical studies of spectra and structures of high-pressure phases of aromatic hydrocarbons and their halogenated derivatives, n-alkanes, teflon, and polyethylene, development and testing of a liquid He temperature high-pressure optical cell, and excimer production in crystalline aromatic hydrocarbons. Results of these studies are presented in some detail. (JSR)

10639 SYNTHESIS OF POLY(METHYL METHACRYLATE-α-CD_3). Mikhailov, M. Kh.; Dirlikob, S. K.; Peeva, N. N.; Georgieva, Ts. P. Vysokomol. Soedin., Ser. B; 16: No. 10, 724-725 (Oct 1974). (In Russian)

Methylmethacrylate-α CD_3 (MMA-d_3) was prepared through the synthesis of the dimethyl ether of methyl-d_3 malonic acid, which was converted to the monoethyl ether of methyl-d_3 malonic acid by the Morgan method. The MMA-d_3 was produced from the monoethyl ether by the Mannich reaction. The polymerization of MMA-d_3 was done in batches with benzoyl peroxide initiator. (JSR)

10640 REDUCTION OF Nb IN CHLORIDE MELTS BY LIQUID METALS AND ALLOYS. Vasin, B. D.; Dolgushin, A. P.; Nichkov, I. F.; Raspopin, S. P. (Ural Polytechnic Inst., Sverdlovsk, USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 100-102(1974). (In Russian).

The reduction of Nb^{3+} by liquid Zn, Al, and their alloys with 16 wt. % Al was studied experimentally in NaCl–KCl–$NbCl_3$ melts under purified Ar at 700°C. The trivalent Nb was completely reduced to the metallic state in these conditions. In studies on the simultaneous reduction of Zr^{4+} and Nb^{3+} by Zn–Al alloys the Zr^{4+} was completely reduced to the metallic state. However, it was totally assimilated by the alloy, but the Nb was only partially assimilated. (JSR)

10641 INTERACTION OF HOLMIUM SESQUIOXIDE WITH Cl_2 + CO. Ivashentsev, Ya. I.; Koroleva, G. A.; Stoyanova, M. I. (Krasnoyarsk Inst. of Ferrous Metals, USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 109-113(1974). (In Russian).

Chlorination of holmium oxide by a 1:1 mixture of Cl_2 + CO was studied at 25 to 718°C. At the higher processing temperature the holmium oxide was less reactive. Kinetic data were calculated for chlorination of Ho_2O_3 at 700, 900 and 1200°C, to give apparent energies of activation. (tr-auth)

10642 LOW-TEMPERATURE SYNTHESIS OF XENON FLUORIDES. Malkova, A. I.; Tupikov, V. I.; Isakov, I. V.; Dudarev, V. Ya. Zh. Neorg. Khim.; 19: No. 7, 1729-1733(Jul 1974). (In Russian).

Radiation and photochemical synthesis of xenon fluorides at 77°K was studied. Gamma radiation or light acted on a condensed mixture of xenon and fluorine to form xenon difluoride. The radiation-chemical yield of XeF_2 was 3 to 10 molecules, depending on the composition of the initial mixture. The radiation-chemical yield of XeF_2 decomposition was ~0.2, with XeF being one stage of the decomposition. X-ray phase analysis and NMR methods were used to confirm the step-wise formation of xenon fluorides in a high-voltage electrical discharge. Parameters of the NMR spectra of XeF_2 and XeF_4 in the liquid phase and in solution are presented. (tr-auth)

10643 MECHANISM OF REDUCTIVE ELIMINATION. I. Dinuclear Elimination of Hydrogen from Cis-Dihydridotetracarbonylosmium. Evans, J.; Norton, J. R. (Princeton Univ., NJ). J. Amer. Chem. Soc.; 96: No. 24, 7577-7578(27 Nov 1974).

Deuterium labelling data from the thermolysis of $H_2Os(CO)_4$

and the kinetics of the decomposition were used to determine the mechanism for the release of hydrogen from the compound. A three-step mechanism was proposed and verified from mass spectrometric analysis of the reaction products from heating the dihydride under ^{13}CO atmosphere which show that decomposition occurs faster than carbonyl exchange. These data show that the $H_2Os(CO)_4$ decomposes by the loss of CO with subsequent dinuclear elimination of hydrogen. (JSR)

10644 ADDUCTS BETWEEN LANTHANIDE NITRATES AND ISOTHIOCYANATES WITH DIPHENYL-PHOSPHINYL-MORPHOLIDE (DPPM). Zinner, L. B.; Vicentini, G.; Rothschild, L. (Univ., Sao Paulo, Brazil). J. Inorg. Nucl. Chem.; 36: No. 11, 2499-2505(Nov 1974).

The compounds obtained from the reaction between hydrated lanthanide nitrates, thiocyanates and diphenyl-phosphinyl-morpholide (DPPM) in ethanol are described. The adducts were characterized by elemental analysis and have the general formulas $Ln(NO_3)_3 \cdot 3DPPM$ (Ln = La to Lu, Y), $Ln(NCS)_3 \cdot 4DPPM$ (Ln = La, Ce, Pr, Nd) and $Ln(NCS)_3 \cdot 3DPPM$ (Ln = Sm to Lu, Y). The ir spectra, molar conductances in nitromethane and nitrobenzene, and X-ray powder patterns of the compounds were determined. (auth)

10645 SURFACE AREA OF SULPHIDES BY ISOTOPIC SURFACE EXCHANGE METHOD. Chetty, K. V.; Naidu, P. R. (Sri Venkateswara Univ., Tirupati, India). pp 79-83 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The surface areas of antimony sulfide, mercuric sulfide, and cadmium sulfide were determined by the isotopic exchange method using ^{203}Hg for the Hg and Cd sulfides and ^{124}Sb for the antimony sulfide. The surface areas measured by this technique were reproducible. The large surface area found for the cadmium sulfide was attributed to the smaller particle size and the presence of pores, cracks, and cavities. (JSR)

10646 COMPLIANCE CONSTANTS FOR SOME METAL–CARBON AND METAL–OXYGEN BONDS. Kasmir Raja, S. V.; Pandian, S. J.; Savariraj, G. A. (St. Joseph's Coll., Tiruchirapalli, India). Indian J. Pure Appl. Phys.; 12: No. 8, 554-556 (Aug 1974).

The force and compliance constants of some metal complexes containing metal-carbon and metal-oxygen bonds are evaluated and the flexibility of such bonds is discussed. The importance of the compliance scheme in the case of metal complexes is stressed. Complexes covered include acetylacetone complexes of La, Pr, and Nd. (4 tables) (DLC)

10647 KINETICS OF THE DEHYDROGENATION REACTIONS OF ISOPENTENES TO ISOPRENE. I. Laws Governing Coke Formation During the Course of the Reaction. Voikina, N. V.; Makhlis, L. A.; Kiperman, S. L.; Bogdanova, O. K. (Inst. of Organic Chemistry, Moscow). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 582-589(1974).

Translated from Kinet. Katal.; 15: No. 3, 657-665(1974).

Kinetic and radiochemical methods were used to obtain data on coke formation on the surface of the catalyst during the course of the dehydrogenation reaction of isopentene to isoprene in a gradientless system. With small partial pressures of isoprene, the fraction of coke forming from it does not exceed 40%; the remaining amount of carbon deposits arises from isopentene. With an increase in the amount of isoprene (after a definite limit has been reached), the fraction of coke arising from it increases and becomes predominant. The rate of carbon formation during the course of the reaction, in a determined interval of time, remains constant. An amount of carbon deposits right up to 33-48% of a monolayer covering of the surface has no effect on the steady-state reaction rate of the dehydrogenation of isopentene. A stagewise scheme is proposed which is in agreement with the observed regularities. (auth)

Isotope Effects

10648 STUDY OF THE MECHANISM OF THE CATALYTIC OXIDATION OF HYDROGEN ON OXIDES OF PERIOD IV METALS BY MEANS OF THE KINETIC ISOTOPE EFFECTS. Ismagilov Z. R.; Popovskii, V. V.; Bulgakov, N. N.; Semenova, O. I.; Pilipenko, V. I. Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 2, 349-354(1974).

Translated from Kinet. Katal.; 15: No. 2, 401-407(1974).

The kinetic-isotope-effect (KIE) method was used to elucidate the details of the oxidation of hydrogen on oxides of period IV metals. It was found that the rate of oxidation of D_2 at identical temperatures and partial pressures is less than the rate of oxidation of H_2 by a factor of 1.2 to 1.7. The reaction orders with respect to hydrogen and deuterium and the activation energies of the oxidation of both isotopes on a given oxide were practically equal. Regular changes in the KIE as the strength of the surface oxygen bond changes were revealed. The kinetic data and KIE values are used to elucidate the reaction mechanism. (auth)

10649 KINETIC AND SOLVENT ISOTOPE EFFECTS IN OXIDATION OF ACETOPHENONES BY VANADIUM(V). Kelikar, M. S.; Shanker, R. (Univ. of Udaipur, India). Curr. Sci. (India); 43: No. 24, 781-782(20 Dec 1974).

Results of a study of kinetic and solvent isotope effects in oxidation of acetophenone by vanadium (V) under acid conditions are reported. The reaction was studied spectrophotometrically by following the rate of formation of vanadium (IV) species at 680 and 750 nm. The error in the measurement of rate constants is ±5%. (LK)

10650 ROLE OF RADICAL AND ORGANOCOPPER INTERMEDIATES IN AROMATIC DIAZONIUM DECOMPOSITION INDUCED BY CUPROUS ION. Cohen, T.; Lewarchik, F. J.; Tarino, J. Z. (Univ. of Pittsburgh). J. Amer. Chem. Soc.; 96: No. 25, 7753-7760(11 Dec 1974).

When methyl iodide was used as a radical trap in the reaction of p-nitrobenzenediazonium tetrafluoroborate (1) with tetrakis-(acetonitrile)copper(I) perchlorate in homogeneous acetone to produce 4,4′-dinitrobiphenyl (2) and 4,4′-dinitroazobenzene (3), it was found that p-iodonitrobenzene is formed at the expense of the dinuclear products (2 and 3), but that the ratio of the latter two remains essentially constant over a wide range of concentrations of methyl iodide. This finding is taken to indicate that aryl radicals are precursors of both 2 and 3, and that the kinetic order in aryl radicals is identical for the production of 2 and 3. The quantitative effect of methyl iodide in diverting the radicals from the production of dinuclear compounds leads to the conclusion that this order is between first and second. The effectiveness of radical traps in this system is methyl iodide > tetrahydrofuran > perdeuteriotetrahydrofuran > acetone; the latter three traps yield nitrobenzene. With a given radical trap, the ratio of atom transfer to dinuclear product formation increases with decreasing concentration of copper(I). In view of the effect of added methyl iodide and of the isotope effect for hydrogen transfer, this behavior is thought to result from cuprous ion mediated conversion of aryl radicals to dinuclear products. The ratio of biaryl to azoarene increases with increasing concentrations of diazonium and cupric ion and with decreasing concentrations of cuprous ion. A mechanism consistent with these facts involves the reversible reaction of an aryl radical with copper(I) followed by reaction of the resulting arylcopper(II) intermediate with another aryl radical to produce the key diarylcopper(III) species 5. The latter can split out copper(I) to form the biaryl in a reductive elimination step, or it can become reversibly reduced by copper(I) to a diarylcopper(II) which, in turn, can be irreversibly reduced to an organocopper(I) compound capable of combining with diazonium ion to produce azoarene. Either diazonium or copper(II) ions are capable of reoxidizing the diarylcopper(II) intermediate to the diarylcopper(III) species. Apparent trapping of an organocopper intermediate by protonation with acids and by methylation and phenylation with methyl iodide and iodobenzene, respectively, lends support to this novel scheme which appears to be the simplest mechanism capable of explaining all known facts about this type of reaction. (auth)

10651 KINETIC ISOTOPE EFFECTS IN THE REACTIONS OF HYDROGEN AND DEUTERIUM ATOMS WITH DIMETHYL ETHER AND METHANOL. Meagher, J. F.; Kim, P.; Lee, J. H.; Timmons, R. B. (Catholic Univ. of America, Washington, DC). J. Phys. Chem.; 78: No. 26, 2650-2657(19 Dec 1974).

The kinetics and mechanism of the reactions of H and D atoms with CH_3OCH_3 and CH_3OH have been investigated using flow discharge methods. The specific rate constant for the reaction $H + CH_3OCH_3 \rightarrow H_2 + CH_2OCH_3$ was found to be $(1.3 \pm 0.5) \times 10^{13}$ exp $(-4700 \pm 100/RT)$ cm^3 mol^{-1} sec^{-1}. The specific rate constant for the corresponding reaction with methanol $H + CH_3OH \rightarrow H_2 + CH_2OH$ is recommended to be 6.5×10^{12} exp $(-5440 \pm 150/RT)$ cm^3 mol^{-1} sec^{-1}. This value is based on an assumed preexponential factor obtained from the CH_3OCH_3 results. Major emphasis was placed on comparing the magnitude of the kinetic isotope effects in the reactions of H and D atoms with CH_3OCH_3 and CH_3OH. The temperature dependence of the kinetic isotope effects of these two molecules was found to be equal, within experimental error. From this it is concluded that the reactive intermediates formed in the attack of H atoms on CH_3OCH_3 or CH_3OH must be nearly identical with respect to bond breakage and bond formation in the activated complex. Thus, the substitution of an H atom for the CH_3 group in going from CH_3OCH_3 to CH_3OH results, apparently, in relatively little effect on the reaction dynamics in the case of H atom attack reactions studied in this work. (auth)

10652 ACID AND MICELLAR CATALYSIS OF THE DECOMPOSITION OF 9-ALKYLPURINE-6-DIAZOTATES. Bunton, C. A.; Wolfe, B. B. (Univ. of California, Santa Barbara). J. Amer. Chem. Soc.; 96: No. 25, 7747-7752(11 Dec 1974).

At pH > 1, the decomposition of 9-propylpurine-6-diazotate (Ia) in aqueous solution gives 9-propylhypoxanthine (IIa), but at lower pH, and especially in the presence of chloride ion, Ia gives 9-propyladenine (IIIa) by denitrosation. For the protonation of Ia, $pK_a = 5.32$, and for protonation of the diazohydroxide, it is 1.34. At pH > 1, the reaction is general acid catalyzed with a slow proton transfer to the diazohydroxide, in agreement with a small, but normal, deuterium solvent isotope effect for hydronium ion catalysis. The rate increases steadily with decreasing pH up to 1, where a plateau is observed, and at pH < 0, the rate again increases because of incursion of denitrosation, and the pH-rate profile can be fitted quantitatively up to pH 0. The spectra of the intermediate diazohydroxide and its conjugate acid have been measured. Anionic micelles of sodium lauryl sulfate catalyze, and cationic micelles of cetyltrimethylammonium bromide inhibit the decomposition of 9-octylpurine-6-diazotate (Ib). (auth)

10653 HETEROBIHALIDE IONS. Nuclear Magnetic Resonance Spectroscopy of Strong Hydrogen Bonds. Fujiwara, F. Y.; Martin, J. S. (Univ. of Alberta, Edmonton). J. Amer. Chem. Soc.; 96: No. 25, 7625-7631(11 Dec 1974).

The hydrogen and fluorine NMR spectra of the fluorine bihalide ions FHX^- (X = F, Cl, Br, and I) complete our study of the ten bihalide ions in aprotic solvents. The H–F coupling constant was resolved in all four fluorine bihalides. Exchange of fluorine is slow; exchange of the other halogens is fast on the NMR time scale. The formation and interconversion equilibria may be adequately interpreted by assuming quantitative hydrogen transfer to the most basic (the smallest) halide ion in the system. Consistent with this, we find that the predominant complex in a solution of HCl and excess Br^- is $ClHBr^-$ not $BrHBr^-$ as previously reported (Fujiwara and Martin, J. Chem. Phys., 56: 4091 (1972)); the proton shieldings in these ions are coincidentally the same. A heterobihalide ion XHY^- behaves as an anion-molecule H-bonded complex XH ... Y^-, where Z_X is less than Z_Y. A simple electrostatic interpretation of the charge shifts on H bonding appears adequate to account for the observed formation constants and hydrogen shieldings. It is possible to make predictions of the bond lengths and charge distributions in the heterobihalide ions. The ^{19}F NMR spectrum of a roughly equimolar solution of Et_4NHF_2 and Et_4NDF_2 acetonitrile at –10 is given. Isotope effects are discussed. (auth)

10654 PRECIPITATION AND DISSOLUTION POTENTIALS OF ELECTROLYTES IN D_2O, ACETONE, AND FORMAMIDE. Rastogi, R. P.; Shukla, R. D.; Bhagat, S. (Univ. of Garakhpur, India). J. Electrochem. Soc.; 121: No. 12, 1563-1569(Dec 1974).

Precipitation, dissolution, diffusion, and phase potentials of KCl, KBr, and NaCl were measured in D_2O, acetone, and formamide in nitrogen atmosphere. The techniques adopted were similar to those used previously for KCl, NaCl, $BaCl_2$, and NH_4Cl in H_2O. The true dissolution and precipitation potentials were found to be negative for KCl and NaCl in H_2O and D_2O (smaller numerically in the latter) and for KBr in D_2O. However, the dissolution potential of KCl and KBr in acetone and formamide and of NaCl in acetone is positive and of higher magnitude. The temperature, concentration, and time dependence of the dissolution potentials have been investigated. The decay of the precipitation potential and of the apparent diffusion potential with time was studied. The experimental results show that the precipitation potential increases with undercooling. The transport number of K^+ and Br^- in formamide was also measured. The results support the hypothesis that the precipitation and dissolution potentials arise on account of the unequal mobilities of the ions moving to and away from the crystal face. (auth)

10655 UNUSUAL INVERSE PRIMARY DEUTERIUM ISOTOPE EFFECT. Factors Operating in the Tunneling Mechanism of Chromium(VI) Oxidation of Alcohols. Kwart, H.; Nickle, J. H. (Univ. of Delaware, Newark). J. Amer. Chem. Soc.; 96: No. 24, 7572-7573(27 Nov 1974).

The temperature dependent isotope effect criterion (TIC) was used to detect and verify a tunneling mechanism in the Cr(VI) oxidation of the sterically hindered di-tert-butylcarbinol. Kinetic runs, correlated in Arrhenius relations, show that the TIC parameters are dependent on $[H^+]$. The TIC parameters have magnitudes which produce $k_H/k_D = 1.0$ at 25°, but at 35° an inverse isotope effect $k_H/k_D = 0.8$ is realized. The TIC parameters do not vary linearly with acidity, although the isotope effect at 25° decreases with increasing acidity. The assumption of a rate-determining decomposition of chromate ester in ordinary Cr(VI) alcohol oxidations was questioned. (JSR)

10656 THE COLLINEAR Cl+XY SYSTEM (X,Y=H,D,T). A COMPARISON BETWEEN QUANTUM MECHANICAL, CLASSICAL, AND TRANSITION STATE THEORY RESULTS. Baer, M. (Department of Chemical Physics, The Weizmann Institute of Science, Rehovot, Israel); Halavee, U.; Persky, A. J. Chem. Phys. 61: No. 12, 5122-5131 (15 Dec 1974).

In this work, exact quantum mechanical (QM) and classical (CL) transition probabilities for the Cl+XY (X,Y=H,D,T) collinear system are compared. The calculations were performed using a semiempirical LEPS surface. The main features discussed are tunneling and threshold behavior for both the ground state and the first excited state of the hydrogen molecule. In the second part, kinetic isotope effects are presented and discussed. Those were calculated in three different ways, using (i) QM transition probabilities, (ii) CL transition probabilities, and (iii) transition state theory (TST–1D). Tunneling coefficients k_{QM}/k_{CL} and k_{QM}/k_{TST} were calculated and discussed. Finally, a brief comparison with experimental data was performed. (auth)

10657 AB INITIO STUDY OF THE $X^2\Pi$ AND $A^2\Sigma^+$ STATES OF OH. I. POTENTIAL CURVES AND PROPERTIES. Chu, S. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory, Cambridge, Massachusetts 02138); Yoshimine, M.; Liu, B. J. Chem. Phys. 61: No. 12, 5389-5395 (15 Dec 1974).

Accurate ab initio CI potential curves and molecular properties are presented for the $X^2\Pi$ and $A^2\Sigma^+$ states of OH. Results with known experimental values in parentheses are $R_e(X^2\Pi) = 1.841(1.834)$ bohr, $R_e(A^2\Sigma^+) = 1.906(1.913)$ bohr, $D_e(X^2\Pi) = 4.43(4.63)$ eV, $D_e(A^2\Sigma^+) = 2.29(2.53)$ eV, μ (OH,$X^2\Pi$,v=0) = 1.634(1.668) D, and μ (OD,$A^2\Sigma^+$,v=0) = 1.861(1.72±0.10) D. Spectroscopic constants calculated from the theoretical potential curves are in satisfactory agreement with experimental results. Other molecular properties studied include quadrupole moments and the electric field gradient at the nuclei. (auth)

10658 KINETIC ISOTOPE STUDY OF THE REACTION OF METHYL RADICALS WITH AMINO ACIDS AND ALIPHATIC ACIDS IN AQUEOUS SOLUTIONS. I. Kinetic Isotope Effect of Deuterium in the Abstraction of Hydrogen from an α–C–H Bond. Moger, G.; Mink, G.; Nemes, I.; Cserhegyi, A.; Moger, D. (Central Scientific-Research Inst. of Chemistry, Budapest). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 512-517(1974).

Translated from Kinet. Katal; 15: No. 3, 573-580(1974).

A study was made of the reactions of methyl radicals with amino acids deuterated in the α–C–H bond and in the functional groups. It was found that hydrogen is abstracted only from the hydrocarbon bonds of the amino acids dissolved in water. The kinetic isotope effects for the abstraction were determined for the reaction of methyl radicals with the α–C–H bond, and it was shown that $(k^H/k^D)_{CH_3OH} > (k^H/k^D)_{NH_3CH_2COO^-} > (k^H/k^D)_{NH_3CH(CH_3)COO^-}$. By comparing the present and literature results it was shown that the stronger the bond being broken, the greater the value of k^H/k^D. The temperature dependence of the relationship $(k^H/k^D)_{NH_3CH_2COO^-}$ was also studied. From a comparison of the results obtained with literature data it was concluded that, for a given bond type, the value of the kinetic isotope effect in hydrogen abstraction reactions by free radicals is slightly dependent on the phase in which the reaction occurs. (auth)

10659 DETERMINATION OF VIBRATION–ROTATION LINE STRENGTHS FOR HF AND DF BY USE OF AN HF/DF cw LASER. Hinchen, J. J. (United Aircraft Research Labs., East Hartford, CT). J. Opt. Soc. Amer.; 64: No. 9, 1162-1163(Sep 1974).

A small cw mixing laser operating on a single wavelength and tunable over about 400 MHz was used to measure absorption coefficients for HF and DF in the Doppler-broadened region and for HF in the pressure-broadened regime. At low pressure, the line profile was experimentally determined and from measurements at line center, values were obtained for the radiative lifetime of HF and DF of 6.16×10^{-3} s and 3.13×10^{-3} s, respectively. High-pressure measurements yielded the value of 1.30×10^8 s^{-1} $torr^{-1}$ for the HF optical-broadening collision frequency. (auth)

10660 ISOTOPE EFFECTS IN COLLISIONS OF THE SECOND KIND. Basov, Yu. G.; Panchenkov, G. M. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 334-336(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 574-577(Mar 1974).

A formula was derived for the isotope separation factor in collisions of the second kind. Calculations based on this formula have shown that the separation factors can be high under these conditions, particularly at a low gas temperature in the discharge plasma. Experimental data are presented for the effect of the addition of argon on the redistribution of isotopes when oxygen reacts with hydrogen in a silent discharge. They are discussed and compared with the calculated results. (auth)

10661 SOLUBILITY OF He, Ne, AND Ar IN HEAVY WATER OF DIFFERENT ISOTOPIC COMPOSITIONS AT 283 TO 318°K.

Abrosimov, V. K.; Strakhov, A. N.; Krestov, G. A. (Ivanovo Power Engineering Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol.; 17: No. 10, 1463-1465(1974). (In Russian).

Data are presented on the solubility of He, Ne, and Ar at 283-318°C in heavy water of different isotopic compositions. With an increase in the D_2O, the solubility of the gases increased. An anomalous increase was observed with a small addition of D_2O to ordinary water. The data obtained are discussed with regard to the effect of the dissolved gases and the isotopic composition on the structure of the water. (tr-auth)

10662 PART I. STEREOCHEMICAL DEPENDENCE OF THE CHEMICAL SHIFT ISOTOPE EFFECT. PART II. THE COPE REARRANGEMENT IN BRIDGED HOMOTROPILIDENES. PART III. CONFORMATIONAL PREFERENCES OF A SERIES OF 1,3-DISUBSTITUTED BUTADIENES. Greifenstein, L. G. Chicago; Northwestern Univ. (1974). 110p. University Microfilms Order No. 74-28,633.

Thesis (Ph. D.).

In order to distinguish between distance-dependent field effects and angular-dependent inductive effects, the geminal and vicinal deuterium isotope effects on ^{19}F shifts were determined for a series of cyclohexyl and 2-norbornyl fluorides. The vicinal examples contained known torsional arrangements about the central carbon–carbon bond. The data support the theory that such vicinal isotope effects arise from vibrationally-based inductive effects, rather than distance-dependent intramolecular field effects. However, the data do not permit generalization to include the geminal effects. The barrier to the Cope rearrangement in bridged homotropilidenes is influenced by steric and electronic factors. In an effort to assess the relative importance of these effects, the activation parameters for barbaralone (23) and 9-methylenebarbaralane (24) were determined from their temperature-dependent NMR spectra. The considerably higher barrier for 23 ($\Delta G_c^{\ddagger}$ = 10.5 kcal/mole) than for 24 ($\Delta G_c^{\ddagger}$ = 9.3 kcal/mole) was attributed to greater-electron withdrawal in the bishomoaromatic transition state. In analogous substituted compounds, the degeneracy of the Cope rearrangement is lifted and positional equilibria occur. A series of 1,3-disubstituted butadienes (43a-d) was synthesized and studied spectroscopically. The NMR and uv spectra of 43a-d revealed only planar forms. (Diss. Abstr. Int., B)

10663 HYDROGEN ADSORPTION OF ZINC OXIDE AND ON SUPPORTED PLATINUM. Dixon, L. T. Baltimore; Johns Hopkins Univ. (1974). 172p. University Microfilms Order No. 74-27,907.

Thesis (Ph. D.).

Kinetic and equilibrium isotope effects were studied for type I hydrogen, deuterium and hydrogen deuteride adsorption on zinc oxide. At room temperature, there is no equilibrium isotope effect for hydrogen versus deuterium, but the preferred form of adsorption of hydrogen deuteride appears to be $Zn-\overset{H}{\underset{D}{O}}$ rather than $Zn-\overset{D}{\underset{H}{O}}$ by a factor of two to three. Kinetic isotope measurements reveal that hydrogen adsorbs faster than deuterium by a factor of at least five at –195°C. The kinetic isotope effect for HD at –195°C reveals $Zn-\overset{D}{\underset{H}{O}}$ is the favored form by a factor of 20-100. Approximate computations of these effects based on observed IR frequencies reveal these effects are explicable provided we assume the bending vibrations for adsorbed species are either very low frequency compared to those observed for simple molecules or that the adsorption is mobile at room temperature. The reversibly adsorbed hydrogen and deuterium on zinc oxide at –195°C and –183°C (type III) were examined by adsorption and infrared techniques. The isotherms show a significant isotope effect and yield isosteric heats at low coverage of 2.2 to 2.5 kcal. Infrared studies and the temperature and pressure dependence show this hydrogen is present in molecular form and is limited to 5 to 10% of the surface. Poisoning studies with water suggest it occurs on the same sites as the dissociative type I hydrogen. Interpretation of the spectral results and the isotope effect suggest that there is a considerable barrier to rotation on the surface. The possible role of such a species in the ortho-para hydrogen conversion is discussed. The adsorption of hydrogen on alumina-supported platinum was also studied by infrared spectra and adsorption measurements. Gas chromatographic analyses establish that at low temperatures the exchange reaction proceeds quite rapidly at –195°C. At –195°C the infrared band at 2120 cm^{-1} is not affected by deuterium exchange whereas the band at 2060 cm^{-1} is significantly diminished. There is evidence that there is an influence of hydroxyl groups on the form giving rise to the band at 2060 cm^{-1}. (Diss. Abstr. Int., B)

10664 ELECTRONIC SPECTRA OF BENZENE ISOTOPES IN MIXED CRYSTALS. Van Pruyssen, J. M. New Haven; Yale Univ. (1974). 221p. University Microfilms Order No. 74-26,352.

Thesis (Ph. D.).

Some environmental effects on the electronic spectra of benzene were investigated. The fluorescence spectrum of protonated benzene in a deuterated benzene host crystal is presented. It was found that the gas-to-crystal shift on the $S1 \rightarrow S0$ transition cannot be correlated in a simple manner to the molecular properties of the solvent, indicating that the size and the symmetry of the crystal site are the most important parameters. The phosphorescence spectra of benzene isotopes in borazine host crystals show that the effective site symmetry is very nearly D_{3d}. The benzene molecule is distorted in its triplet state causing an "isomeric splitting" of the phosphorescence origin of the mono and para-deuterobenzene isotopes. The distortion is small enough that it does not alter the vibronic selection rules derived from the effective site symmetry and the molecular point group. However, the isomeric splittings are much larger than for a perdeuterobenzene host crystal. The data suggests that benzene in the zeroth vibrational level of its first triplet state is intrinsically distorted. The phosphorescence lifetimes of the two p-C6H4D2 isomers differ by about 0.7 sec. This indicates an isotope effect on the $T1 \rightarrow S0$ interconversion rate. This effect is probably due to the isotopic dependence of guest-host interactions. Phonon sidebands in the fluorescence and phosphorescence spectra of pure and isotopically mixed benzene crystals were observed. (Diss. Abstr. Int., B)

Isotope Exchange and Isotope Separation

10665 (COO-3416-16) KINEMATICS OF HYDRIDE TRANSFER REACTIONS IN METHYLSILANE. Mayer, T. M.; Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Davey Lab.). 1974. Contract AT(11-1)-3416. 18p. Dep. NTIS $4.00.

Kinematics of hydride transfer reactions in methylsilane were investigated by isotopic distribution measurements and kinetic energy analysis of product ions in a tandem mass spectrometer. Reactions are observed to proceed predominately via a direct stripping type process, yielding an $CH_3SiD_2^+$ or $CH_3SiH_2^+$ ion with very little kinetic energy, and by a complex formation mechanism that is particularly prominent at low collision energies. The process is interpreted as making a transition from complex in nature at low energies to direct at high collision energies. (auth)

10666 PROTON MOBILITY OF HYDROGEN ATOMS IN BIS-ARENE COMPLEXES OF CHROMIUM. Kursanov, D. N.; Setkina, V. N.; Gribov, B. G.; Bykova, E. V. (Inst. of Hetero-Organic Compounds, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 4, 719-723(Apr 1974).

Translated from Izv. Akad. Nauk SSR, Ser. Khim.; 23: No. 4, 751-755(Apr 1974).

The reaction of isotopic exchange of hydrogen of two types of bis-π-arene complexes of chromium $(Arene)_2Cr$ (where Arene = benzene, toluene, ethylbenzene) with deuteroethanol in the presence of sodium ethylate and $[(Arene)_2Cr]^{\oplus}I^{\ominus}$ with deuterium oxide in the presence of KOD was studied. The rate of isotopic exchange of the hydrogen of both types of chromium complexes increases in proportion to the concentration of the bases, and not only the hydrogen atoms of the aromatic ring, but also the hydrogens of the side chain participate in the exchange. The factors of the partial rate were determined for the phenyl and methyl hydrogen atoms in bis-π-toluenechromium. On the basis of the data of isotopic exchange of hydrogen, the acidity of the C–H bonds in bis-π-benzenechromium was estimated (pK_a 26.3 ± 0.2). (auth)

10667 UNUSUAL INFLUENCE OF THE ACIDITY OF THE MEDIUM ON THE RATE OF ISOTOPIC EXCHANGE OF HYDROGEN OF $C_6H_5Cr(CO)_2P(C_6H_5)_2$. Kursanov, D. N.; Baranetskaya, N. K.; Losilkina, V. I.; Setkina, V. N. (Inst. of Hetero-Organic Compounds, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 4, 724-726(Apr 1974).

Translated from Izv. Akad. Nauk SSR, Ser. Khim.; 23: No. 4, 756-758(Apr 1974).

When the acidity function H_0 is varied from +1 to –2.5, the rate of the isotopic exchange of hydrogen of benzenechromiumdicarbonylphenylphosphine is directly proportional to the acidity of the medium, while in the case of higher acidities from –2.5 to –7.1, an inverse dependence is observed. (auth)

10668 INFLUENCE OF ELECTRON ACCEPTOR SUBSTITUENTS IN AROMATIC LIGANDS OF π-ARENECARBONYL COMPLEXES OF CHROMIUM ON THE RATE OF ISOTOPIC EXCHANGE OF HYDROGEN WITH ACIDS. Baranetskaya, N. K.; Zdanovich, V. I.; Mysov, E. I.; Kolobova, N. E.; Anisimov, K. N.; Setkina, V. N.; Kursanov, D. N. (Inst. of Hetero-Organic Compounds, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 4, 727-730(Apr 1974).

Translated from Izv. Akad. Nauk SSR, Ser. Khim.; 23: No. 4, 758-762(Apr 1974).

The acetyl group in $C_6H_5COCH_3Cr(CO)_3P(C_6H_5)_3$ and the protonated dimethylamino group in $(CH_3)_2NHC_6H_5Cr(CO)_3X$ increase the rate of the reaction of isotopic exchange of hydrogen in acid media in comparison with the corresponding unsubstituted compounds. $(CH_3)_2NC_6H_5Cr(CO)_3$ and $(CH_3)_2NC_6H_5Cr(CO_2P(C_6H_5)_3$ undergo a reaction of protodeamination in acid media. (auth)

10669 NATURE OF THE INTERACTION OF π-CYCLOPENTADIENYL COMPLEXES OF MANGANESE WITH ACIDS UNDER CONDITIONS OF HYDROGEN EXCHANGE. Nemirovskaya, I. B.; Setkina, V. N.; Ginzburg, A. G.; Kursanov, D. N. (Inst. of Hetero-Organic Compounds, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 4, 731-735(Apr 1974).

Translated from Izv. Akad. Nauk SSR, Ser. Khim.; 23: No. 4, 762-767(Apr 1974).

The influence of the acidity of the medium on the rate of isotopic exchange of hydrogen and the degree of protonation of the complexes $CpMn(CO)(Ph_2PCH_2CH_2PPh_2)$ and $CpMn(CO)_2PPh_3$ was studied. The dependence of the rate of exchange on the acidity of the medium for the complex $CpMn(CO)(Ph_2PCH_2CH_2PPh_2)$ is described by a curve with a maximum, at which the content of the protonated and nonprotonated forms is approximately the same. Evidently the nonprotonated form participates in the step of removal of a proton. (auth)

10670 APPROXIMATE CALCULATION OF THE THERMODYNAMIC ISOTOPIC FACTORS FOR CARBON COMPOUNDS. Galimov, E. M. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 2, 173-175(Feb 1974).

Translated from Zh. Fiz. Khim.; 48: No. 2, 290-294(Feb 1974).

An approximate method of calculating the β-factors of carbon compounds by the summation of quantities termed the "isotopic bond numbers" is proposed. Specific values of these numbers are given for various types of chemical bonds formed by carbon atoms at 300°K. The β-factors obtained by this method are shown to agree satisfactorily with the values obtained by inserting the vibrational frequencies of the isotopic forms into a computer program. The new method can be applied, with a known approximation, to other compounds, including very complex molecules for which the vibrational problem has not yet been solved. (auth)

10671 POSSIBILITY OF ISOTOPE SEPARATION BY A PHOTOCHEMICAL METHOD. Basov, Yu. G.; Utirov, B. U.; Korovkin, V. K. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 2, 202-203(Feb 1974).

Translated from Zh. Fiz. Khim.; 48: No. 2, 342-345(Feb 1974).

The conditions affecting the achievement of an appreciable separation of isotopes in a photochemical process were examined. A formula was derived for the calculation of the separation factor when the chemically reacting species is excited to some quantum level. The complete separation of isotopes is influenced by the flow rate of the gas mixture through the photochemical reactor. (auth)

10672 EXCHANGE OF HYDROGEN BROMIDE AND DEUTERIUM BEHIND REFLECTED SHOCK WAVES. Kern, R. D.; Nika, G. G. (Univ. of New Orleans). J. Phys. Chem.; 78: No. 25, 2549-2554(5 Dec 1974).

A complementary shock tube facility was used to study the reaction of equimolar mixtures of HBr and D_2 diluted by inert gases over the temperature range 2030-2515°K. The total gas density in the reflected shock zone was varied, $1.68\text{-}1.92 \times 10^{-6}$ mol/cm^3. One set of experiments involved the analysis of infrared emission from HBr and DBr. The second set of data was collected using a time-of-flight mass spectrometer to sample the reacting gas mixture at 20-μsec intervals. Both sets exhibited a quadratic time dependence with respect to product formation. The combined order with respect to the reactants was found to be second order. Due to experimental difficulties, attempts to determine the order with respect to inert gas dependence were not successful. The kinetic profiles were fit to the equation $[1 - \frac{3}{2} f_{DBr}] = \exp(-k[HBr]_0 t^2)$, $k = 10^{22.31 \pm 0.48} \exp(-83{,}020 \pm 4970/RT)$ cm^3 mol^{-1} sec^{-2}. Assuming an order of one for the inert gas dependence, reaction profiles for an atomic mechanism were calculated using the experimental data presented herein and a collection of literature rate constants for the dissociation and three-center steps. Good agreement was obtained. This is the first report of a shock tube study involving the exchange of a diatomic molecule with deuterium that may be explained in terms of an atomic mechanism. (auth)

10673 ^{18}O EXCHANGE STUDIES ON $V_{10}O_{28}^{6-}$ IN AQUEOUS MEDIA. Murmann, R. K. (Univ. of Missouri, Columbia). J. Amer. Chem. Soc.; 96: No. 25, 7836-7837(11 Dec 1974).

In order to gain structural and kinetic information on the decavanadate ion in aqueous solutions, kinetics of the oxygen exchange between solutions of $(NH_4)_6V_{10}O_{28} \cdot 6H_2O$ and H_2O utilizing ^{18}O were studied. Preliminary results indicated that the exchange is slow, there is no spectral change, and a change in pH from 7.2 to 6.7. Evidence points to the conclusion that the decavanadate ion exists essentially unchanged in water solution. Reversible dissociation is suggested as the primary pathway for exchange. (JGB)

10674 ELECTRON THEORY OF PHOTOCATALYTIC REACTION ON SEMICONDUCTORS. II. The Deutero-Hydrogen Exchange Reaction. Vol'kenshtein, F. F.; Nagaev, V. B. (Inst. of Physical Chemistry, Moscow). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 2, 325-331(1974).

Translated from Kinet. Katal.; 15: No. 2, 373-380(1974).

A mechanism for the H-D exchange reaction is developed within the framework of the electron theory of catalysis. Both the dark-reaction and the photoreaction are discussed. A summary of experimental material is presented. A comparison is set up between theoretical and experimental results. (auth)

10675 HYDROGEN–TRITIUM EXCHANGE OF PARTIALLY AND FULLY RECONSTITUTED ZINC AND COBALT ALKALINE PHOSPHATASE OF ESCHERICHIA COLI. Brown, E. M.; Ulmer, D. D.; Vallee, B. L. (Harvard Medical School, Boston). Biochemistry; 13: No. 26, 5328-5334(17 Dec 1974).

The influence of metals on the rate of hydrogen–tritium exchange of Escherichia coli alkaline phosphatase was studied by the gel filtration technique. At pH 8.0 and 20°C, nearly 90% of the 1200 potentially exchangeable hydrogens of the metal-free apoenzyme exchange within a few minutes; an additional 8% exchange more slowly over the ensuing 12 hr. In contrast, at all times of exchange enzymes fully reconstituted with 4 g-atoms/mol of Co or Zn retain 60 or 70 more hydrogens than the apoenzyme indicating that the metal atoms markedly stabilize the dynamic protein structure. The greater conformational stability of the metalloenzymes is also apparent from examination of the temperature dependence (4 to 35°) of the exchange reaction. The rates of exchange of phosphatases only partially reconstituted with metals, i.e., 2 g-atoms/mol of either Zn or Co, differ both from apo- and holometalloenzymes and from each other. Thus, addition of only two Zn atoms appears to stabilize a discrete set of equilibrium conformers which differ from those generated by two Co atoms, suggesting differing modes of metal binding; both, in turn, are less stable than the equilibrium structures of their corresponding holometalloenzymes. However, in the presence of phosphate, the proton exchange rates of the partially reconstituted metallophosphatases coincide with those observed for their corresponding holometalloenzymes. Hence, phosphate appears to act in concert with metals to promote conformational stabilization. Phosphate also protects the partially reconstituted Zn enzyme against a slow loss of catalytic activity evident under these experimental conditions. (auth)

10676 CARBON ISOTOPE FRACTIONATIONS IN NATURAL GASES. Stahl, W. (Bundesanstalt fuer Bodenforschung, Hanover). Nature (London); 251: No. 5471, 134-135(13 Sep 1974).

It is stated that isotopic studies can be of great interest in hydrocarbon exploration. An attempt is made to evolve a model to explain the isotopic fractionation of CH_4 as a function of the thermocatalytic state of the organic source. The results of isotopic analysis of natural gases from various countries are compared with those of gases from the Federal German Republic. Results are discussed. (UK)

10677 NITROGEN ISOTOPE MIXING REACTION CATALYSED BY POLYCRYSTALLINE METAL WIRES. Eley, D. D.; Russell, S. H. (Univ. of Nottingham, Eng.). Proc. Roy. Soc. (London), Ser. A; 341: No. 1624, 31-44(29 Oct 1974).

The velocity, k_m, of the equilibration reaction $^{28}N_2 + {}^{30}N_2 \rightleftharpoons 2\,^{14}N^{15}N$ over 0.47 to 50 Pa and 1133 to 1623°K obeys the following kinetic laws, for polycrystalline wires, cleaned in ultra-high vacuum, of the metals stated: Re, $k_m = 1.1 \times 10^{20}\, p \exp(-34/RT)$ molecules m^{-2} s^{-1}, W, $k_m = 3.2 \times 10^{25}\, p^{\frac{1}{2}} \exp(-153/RT)$ molecules m^{-2} s^{-1}, Mo, $k_m = 2.1 \times 10^{27}\, p^{\frac{1}{2}} \exp(-177/RT)$ molecules m^{-2} s^{-1}, where the units of T, R, and p are K, kJ mol^{-1} K^{-1}, and Pa respectively. An activated complex treatment in terms of partition functions gives reasonable agreement between theory and experiment for a mechanism for Re of molecular dissociation followed by atom recombination, and for W and Mo a reaction between atoms and molecules, possibly molecular radicals, competing for sites in the chemisorbed layer. The freedom of the activated complexes, relative to the respective adsorbed initial states, appears to decrease over Re > Mo > W. (auth)

10678 CHEMICAL AND RADIOCHEMICAL REQUIREMENTS FOR RADIOISOTOPES USED IN LABELLING. Raghavan, S. V.; Ramamurthy, N.; Desai, C. N.; Mani, R. S. (Bhabha Atomic Research Center, Bombay). pp 25-33 of Proceedings of the Chem-

istry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effect of carrier iodide, common reducing agents, and metallic impurities on the labelling yield in the isotopic exchange reaction between radioiodine $^{131}I/^{125}I$ and organic iodine compounds was studied. Exchange between ^{131}I and organic iodine compounds was inhibited by the presence of carrier iodide and reducing agents. Short heating periods in the presence of common reducing agent appreciably reduced the labelling yield. Cu and to a lesser extent Cr and Mn inhibited the exchange reaction. Aged solutions of radioisotopes gave a lower yield of the labelled compounds. (JSR)

10679 ABSTRACTION FRACTION IN THE REACTION OF DEUTERIUM ATOMS WITH HBr AND HI. Persky, A.; Kuppermann, A. (Arthur Amos Noyes Laboratory of Chemical Physics, California Institute of Technology, Pasadena, California 91109). J. Chem. Phys. 61: No. 12, 5035-5039 (15 Dec 1974).

The reaction between D atoms and HX molecules (X=Br or I) may result in either abstraction of H atoms to yield HD+X or exchange of H atoms to yield DX+H. This reaction was studied at 300°K by photolyzing HX+DX+He mixtures with monochromatic light at two wavelengths. It was found that the abstraction fraction is $0.7_6 \pm 0.1_0$ for X=Br and 0.88 ± 0.08 for X=I. These results are discussed in terms of the dynamics of these reactions. (auth)

10680 KINETICS OF HYDROGEN EXCHANGE BETWEEN ISOBUTYRIC ACID AND ISOBUTYLTHIOL IN VARIOUS SOLVENTS. Gusakova, G. V.; Denisov, G. S.; Smolyanskii, A. L. (Leningrad State Univ.). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 518-521(1974).

Translated from Kinet. Katal; 15: No. 3, 581-585(1974).

The kinetics of hydrogen exchange between isobutyric acid and isobutylthiol in nonpolar solvents, as well as in C_2Cl_4 in the presence of pyridine, was investigated by the method of IR spectroscopy. The rate constant and activation energy of the process were determined. (auth)

10681 COMPARATIVE STUDY OF PHOTOINDUCED ELECTRON PARAMAGNETIC RESONANCE SIGNALS AND HOMOMOLECULAR ISOTOPIC EXCHANGE OF OXYGEN ON TITANIUM DIOXIDE DEPOSITED ON SILICA GEL. Nikisha, V. V.; Shelimov, B. N.; Kazanskii, V. B. (Inst. of Organic Chemistry, Moscow). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 3, 599-603(1974).

Translated from Kinet. Katal; 15: No. 3, 676-680(1974).

A study was made of the electron paramagnetic resonance signals of TiO_2 (deposited on silica gel) with adsorbed oxygen, photoinduced at 77°K. There was detected a signal with $g_{\parallel} = 2.008$ and $g_{\perp} = 2.001$, obviously belonging to $O_{3\,ads}^-$ anion-radicals. These radicals are stable at 77°K and decompose in accordance with the reaction $O_3^- \rightarrow O^- + O_2$ with an increase in the temperature up to 137°K. It is shown that the activity of irradiated TiO_2/SiO_2 with respect to the reaction of the homomolecular isotopic exchange of oxygen correlates qualitatively with the electron paramagnetic resonance signal of $O_{3\,ads}^-$. It is postulated that the isotopic exchange takes place in accordance with the scheme: $^{16}O_{ads}^- + {}^{18}O^{18}O \rightleftharpoons (^{18}O^{18}O^{16}O)_{ads}^- \rightleftharpoons {}^{18}O_{ads}^- + {}^{16}O^{18}O$. (auth)

10682 HYDROPHOBIC SUPPORT CATALYST FOR H–D EXCHANGE. Rolston, J. H.; Stevens, W. H.; Butler, J. P.; Denhartog, J. (to Atomic Energy of Canada Ltd.). Canadian Patent 941,134. 5 Feb 1974.

A process for the exchange of hydrogen isotopes between streams of gaseous hydrogen and liquid water, wherein the streams are brought into contact with one another and a catalyst assembly preferably comprising an inherently hydrophobic porous material such as polytetrafluoroethylene, polyethylene, polystyrene, polymethylmethacrylate or polypropylene carrying a catalytically active metal, for example, platinum, rhodium and nickel. The inherently hydrophobic support allows the catalytically active metal to catalyze the hydrogen isotope exchange between the hydrogen and water vapor from the liquid water whilst retarding loss of activity of the catalytically active metal by contact with liquid water. (CA)

10683 CHROMATOGRAPHIC SEPARATION OF CALCIUM ISOTOPES. Klinskii, G. D.; Knyazev, D. A.; Vlasova, G. I. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 380-382(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 659-662(Mar 1974).

The possibility of the chromatographic separation of calcium isotopes by means of the chemical exchange systems comprising $Ca(H_2O)_8^{2+}$ in the Dowex-50B × 2 cation-exchanger phase and calcium citrate or ethylenediaminetetraacetate in aqueous solution at pH 4.7 and 8.0 respectively was investigated. Measurements of the effective separation factors under Spedding's experimental conditions led to the enrichment coefficients $\epsilon_0 = \alpha - 1 = (3.44 \pm 0.06) \times 10^{-3}$ and $(4.31 \pm 0.32) \times 10^{-3}$ respectively per unit mass difference in the above systems. The heavy isotopes are concentrated in the aquo-complex of the cation-exchange resins. (auth)

10684 ISOTOPE INTERACTION IN MEMBRANE TRANSPORT. Li, J. H. Y. Medford, MA; Tufts Univ. (1973). 203p. University Microfilms Order No. 74-27,716.

Thesis (Ph. D.).

In the nonequilibrium thermodynamics approach both the discrepancy between the tracer and the net flow permeability and the deviation of the ratio of unidirectional fluxes from Ussing's value for independent passive flow of a test species are attributable to the coupling of isotope flows of this test species–isotope interaction. In a collodion-based polyelectrolyte-activated permselective membrane system this coupling was demonstrated for flows of different isotopes of chloride ion, and for several monovalent and a divalent ionic species it was found that when a net flow was induced by either an electrical potential difference or a concentration difference, the measured flux ratio deviated significantly from Ussing's value but agreed closely with the theoretical value which incorporates the influence of isotope interaction. The unlikelihood of the presence of transmembrane mobile carriers in the system studied suggested that the conventional interpretation of the phenomena of discrepant permeabilities and abnormal flux ratios in terms of carrier transport should not be generalized. Further experimental evidence indicated that with the use of the standard methodology in the study of membrane transport nonuniform electrical properties of the membrane could be responsible for the observed phenomena. Thus on one hand the discrepancy and the abnormality were removed in the process of preparing more uniform membranes, and on the other hand by preparing model membranes of specified nonuniformity phenomena similar to those observed previously were reproduced. Theoretically it has been shown that for a homogeneous uniform membrane the phenomena of isotope interaction could be the result of a concentration dependence of the intrinsic parameter which is solely determined by the properties of the test species and the membrane system. Measurements on tracer flows in the absence of net flows give a quantity proportional to this intrinsic parameter, and the phenomenological coefficient characterizing and quantifying the degree of the coupling of isotope flows can be expressed explicitly in terms of the variation of this parameter with the test species concentration. For ionic test species the phenomena of isotope interaction could in addition be the result of the failure of the Nernst-Einstein relation to correlate the electrical mobility of the test ion with its intrinsic diffusive mobility obtained from tracer self exchange measurements. (Diss. Abstr. Int., B)

Feed Materials Processing

Refer also to abstracts 11661 and 12155.

10685 (GJO-107) URANIUM LEACHING: BIBLIOGRAPHY. (USAEC Grand Junction Office, Colo.). Nov 1974. 10p. Dep. NTIS $4.00.

10686 (INIS-mf-1570) STUDY OF CONTINUOUS PRECIPITATION OF AMMONIUM DIURANATE FOR THE PRODUCTION OF CERAMIC UO_2. de Araujo, J. A. (Sao Paulo Univ. (Brazil). Escola Politecnica). 1971. 113p. (In Portuguese). INIS.

Thesis.

Studied here is ammonium diuranate continuous precipitation with high chemical purity, from uranyl nitrate solutions, which leave the stripping column at a pilot plant for uranium purification with solvents. The main purpose is the comparison of the results obtained from the continuous process described here and those from the batch precipitation process, and the achievement of the maximized operational conditions for the best process yield in the ADU production as well. The precipitations were done by a continuous procedure in two different ways. Initially, two on line reactors were used. The first one was fed with uranyl nitrate and ammonium hydroxide of known title, until a desired pH was achieved; the second one where the precipitation itself was done. With the results obtained from the experiments in both reactors, a new set of experiments was done, but using only one reactor, varying the precipitating agent (NH_4OH and NH_3). In some runs the EDTA was also used as a complexing agent for impurities which could remain in the uranyl nitrate. From the obtained data, one can conclude that the best conditions to acquire the ammonium diuranate precipitation by continuous procedure in order to get the UO_2, are: Feed the reactors with a nuclear pure $UO_2(NO_3)_2$ solution ranging from 73 to 100 g U/l; precipitate in two stages, using the 1.4 M and 2.4 M NH_4OH as a precipitating agent, in the first and second reactors, respectively; assure a pH between 5.5 and 6.0 at the output of the ammonium diuranate suspended mix-

ture; initiate the ADU precipitation after the uranyl nitrate solution has reached 60 ± 5°C. (INIS)

10687 (INIS-mf-1572) TECHNOLOGY OF PREPARATION OF UO_2 APPROPRIATE FOR CONVERSION TO UF_4. Ribas, A. G. S. (Sao Paulo Univ. (Brazil). Escola Politecnica). 1973. 107p. (In Portuguese). INIS.

Thesis.

A study of preparation of uranium dioxide appropriate for conversion to UF_4, from ammonium diuranate, using anhydrous NH_3 as the reducing agent is described. The main purpose is to get experience in the UO_2 preparation technology and to fix the operation conditions, in order to install an experimental apparatus for training and small production. The experiments were carried out on a laboratory scale and the experimental parameters studied were: temperature and time of diuranate decomposition, heating rate, temperature and time of reduction, NH_3 excess and flow rate. The best operation conditions were fixed as function of the experimental parameters over the physical and chemical characteristics of the oxides, mainly O/U ratio and specific area, associating these properties to the conversion yield to UF_4. (INIS)

10688 METHOD FOR THE SEPARATION OF HYDROGEN FLUORIDE FROM A MIXTURE OF URANIUM HEXAFLUORIDE AND HYDROGEN FLUORIDE. Pfistermeister, M.; Pokar, J. (to Uran-Isotopentrennungs-G.m.b.H. (URANIT), Juelich (F. R. Germany)). German (FRG) Patent 2231893/A/. 17 Jan 1974. 4p. (In German).

UF_6–HF mixtures are hard to separate from HF due to the formation of an azeotropic mixture. A method was developed, which, by the addition of perfluorated, aliphatic, still weakly basic primary, secondary, or tertiary amines, permits the separation of UF_6 by the formation of a salt-like adduct with HF. (GE)

10689 LEACHING URANIUM ORES FLUIDIZED WITH A POLYELECTROLYTE. Booth, R. B. (to American Cyanamid Co.). US Patent 3,852,403. 3 Dec 1974. Filed date 17 Nov 1972. 22p.

Aqueous suspensions of solids with a wide particle size range having comparatively coarse materials including some larger than 65 mesh and very fine materials including some smaller than 325 mesh settle out with the solids in unclassified and in resuspendable form, when settling in the hindered state under non-Stokes conditions, is effected in the presence of a polymer of the acrylamide-acrylic acid-acrylonitrile type which causes the fines to remain with the large particles and settle out comparatively homogeneously. This aids in preventing deposits of coarse materials in settling tanks, leach tanks, internal combustion engines and their radiators, heat exchangers, cooling towers, flowing streams in natural or man-made water courses, and mine operations, and the polymer in solution can penetrate into coarse material with fines so that settled material can be resuspended, even if the polymer is introduced after at least some settling has occurred. (Official Gazette)

10690 METHOD FOR REDUCING URANIUM TETRAFLUORIDE TO METALLIC URANIUM. Sheller, O. P. (to United States Atomic Energy Commission). US Patent 3,850,623. 26 Nov 1974. Filed date 19 Jan 1961. 6p.

The method comprises heating a reaction mixture of UF_4, Ca in excess of the stoichiometric amount required to reduce the UF_4, an ignition agent, and Li until said mixture ignites, and separating the resulting metal from the resulting slag. The Li is provided in the mixture in a proportion sufficient to produce a LiF content of approximately 15 to 30 mole % in said slag. The ignition agent is selected from the group consisting of iodine and a finely divided mixture of Mg with an alkali metal iodate and an alkali metal peroxide. (Official Gazette)

10691 A STUDY OF CERTAIN ASPECTS RELATING TO THE REACTIVITY OF SOLIDS IN GAS-SOLID REACTIONS DURING THE PRODUCTION OF URANIUM DIOXIDE. Birkill, R. S. (University of the Witwatersrand, Johannesburg (South Africa)). 1972. 220p. INIS.

Copies available from Atomic Energy Board, Pelindaba, Pretoria (South Africa).

Several investigators have attempted to find a means of characterizing ammonium uranates, commonly referred to as ADU, or the intermediate products of the production of uranium dioxide (UO_2) to enable them to predict the sinterability of the UO_2 product or its reactivity towards hydrofluorination. In an investigation by the author on a similar problem in the production of UO_2, it became obvious that, for different ADU preparations, the properties of the products were affected differently by the individual process steps. A basic investigation was undertaken to establish the influence of the process steps on two of the basic properties of the powder products that can affect the final reactivity of the UO_2. These two properties are the surface area per unit mass, and the crystallographic phases of the ADU and of the intermediate products. Type I, II, or III ADU as defined by Debets and Loopstra (1963) can be produced on a plant scale, and the type produced depends on the speed of precipitation. The crystallographic phases have the following influence on the reactivity of the intermediate phases: for ADU of nitrate origin, the calcination products lose all the nitrate by the time that the intermediate ρ/UO_3 is formed; for ADU of sulfate origin, all the sulfate is still present as an integral part of the crystal when the intermediate UO_3 stage is reached during calcination. This influence leads to a difference in reactivity of these UO_3 products during further processing. (INIS)

10692 METAL RECOVERY PROCESS. Hammes, K. W. Sr.; Hammes, K. W. Jr.; Hammes, T. L.; Kayser, P. US Patent 3,840,365. 8 Oct 1974. Filed Date 27 Sep 1971. 14p.

The disclosure is of a process for recovery of metals, including copper and, where present in sufficient quantities, uranium, gold, and silver, from ores. According to the process, the ores are leached and the recovered metals are deposited on metal sheets, particularly on sheets of iron or aluminum. The metals to be recovered are leached from the ore by highly buffered leach solutions of controlled pH in the range of 2 to 4. (Official Gazette)

Radiation Chemistry

Refer also to abstracts 10803, 11520, 11525, 11529, 12124–12126, 12128, and 12747.

10693 (AD-781828) ELECTRICAL CONDUCTIVITY AND RADIOLYSIS OF LEAD AZIDE CONTAINING Cu^{2+} AND Ag^+. Zakhavov, Yu. A.; Savelev, G. G.; Shechkov, G. T. Translated from Izv. Vyssh. Ucheb. Zaved., Khim. Tekhnol.; No. 11, 1191-1194(1967). 6p. (FSTC-HT-23-1174-73). NTIS $4.00.

Change in electrical conductivity, radiation, and thermal stability of PbN_6, coprecipitated with CuN_6 and AgN_3, were studied during radiolysis in vacuum. The data show a decrease in conductivity in proportion to addition of Cu^{2+} ions and a slight decrease with addition of Ag^+ ions. This is due to formation of a CuN_6 intrusion in the PbN_6 solid solution and decrease in concentration of mobile anion vacancies and, tentatively, formation of PbN_6–AgN_3 replacement solid solutions. Saturation with Ag^+ ions occurs only at high concentrations, while radiolysis inhibition by Cu^{2+} ions stops increasing at about 0.05 mole % Cu^{2+}. Silver ion is an electron donor in the process and Cu^{2+} is an acceptor. (GRA)

10694 (AD-782953) CHARGE NEUTRALIZATION AND ELECTRON SCAVENGING IN IRRADIATED DIELECTRIC LIQUIDS. Ausman, G. A. Jr. (Harry Diamond Labs., Washington, D. C. (USA)). Apr 1974. 20p. (HDL-TR-1662). NTIS $3.00.

The Smoluchowski equation, which governs the motion of an isolated electron-ion pair undergoing mutual Coulomb attraction and random walk in a dielectric medium, is modified to include electron scavenging. The solution is obtained numerically for values of time ranging over five orders of magnitude. The results are in accord with recent time-dependent conductivity measurements on n-hexane following radiation-induced ionization. (auth)

10695 (AD-783084) PHOTOIONIZATION SPECTRUM OF SOLVATED ELECTRONS. Aulich, H.; Nemec, I.; Delahay, P. (New York Univ., N. Y. (USA)). Jul 1974. Contract N00014-67-A-0467-0019. 33p. NTIS $3.25.

Photoionization cross sections are reported for solvated electrons at photon energies from 1.2 to 4.1 eV and the sodium species Na(-) (2.8 to 4.1 eV) in hexamethyl phosphoric triamide (HMPA). Cross sections are obtained by the recently developed method of energy distribution curve (EDC) superposition for photoelectron emission by solutions of sodium metal (5 to 96 millimole/liter) in HMPA. The EDC's, spectral response curves for quantum yield, and cross section curves are discussed, and photoionization mechanisms are suggested for the Na(-) species. Experimental methods are briefly outlined. This seems to be the first determination of cross sections for solvated electrons and the Na(-) species in a liquid solution of high ionic conductivity. (auth)

10696 (AD-783085) EXPERIMENTAL METHODS FOR THE DETERMINATION OF THE PHOTOIONIZATION SPECTRUM OF SOLVATED ELECTRONS. Aulich, H.; Nemec, I.; Delahay, P. (New York Univ., N. Y. (USA)). Jul 1974. Contract N00014-67-A-0467-0019. 23p. NTIS $3.25.

The paper covers the following experimental aspects: (1) photoelectron emission cell and operation procedure; (2) optical system and determination of photon flux; (3) electronics and methodology; and, (4) calibration of detectors with a quartz-iodine lamp calibrated by the national bureau of standards. (auth)

10697 (AD-785523) PROTON PULSE RADIOLYSIS. I. Techniques. Final Report. Klein, N.; Sasse, R. A.; Rock, T. J. (Ballistic Research Labs., Aberdeen Proving Ground, Md. (USA)). Aug 1974. 21p. (BRL-1735). NTIS $3.00.

A requirement for the observation of short-lived, transient species in radiation chemistry is the availability of intense pulses of ionizing radiation. Beam control techniques for use with a pulsed, positive ion accelerator have been extended and when applied to the Army Tandem van de Graaf accelerator, make available pulse repetition rates ranging from single pulse operation to 2 million pulses per second. In addition to radiation source development, techniques for the observation of emitted light at very low levels are also described. These techniques have been successfully employed to observe non-Cherenkov light emission from proton-irradiated liquids. The techniques developed provide a powerful tool for the study of radiation phenomena involving species produced shortly after the energy transfer process. (auth)

10698 (AEC-TR-7422/10) NUKLEONIKA. Translation of Nukleonika; 18: No. 10, 439-500(1973). 60p. Dep. NTIS $6.00.

10699 (BARC-751) LUBRICANTS IN NUCLEAR TECHNOLOGY: A BRIEF REVIEW. Srivastava, S. B.; Thomas, V. G. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

The report summarizes the current status of the development and the use of lubricant for variety of purposes in nuclear technology. (33 references) (auth)

10700 (CEA-CONF-2684) ELECTRON SPIN RESONANCE OF γ IRRADIATION INDUCED FREE RADICALS IN POLYVINYLPYRIDINES. Ronfard Haret, J. C.; Lablache Combier, A.; Chachaty, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Service de Chimie-Physique; Lille-1 Univ., 59 – Villeneuve-d'Ascq (France)). [nd]. 40p. (CONF-740971-1). Dep. NTIS (US Sales Only) $5.00.

From conference on organic chemistry; Orsay, France (19 Sep 1974).

Free radicals formed by γ irradiation of polyvinylpyridines in bulk or in glassy solutions have been identified by electron spin resonance. In neutral alcoholic solutions, pyridinyl radicals produced by hydrogen addition to nitrogen are selectively formed. The analysis of ESR spectra shows that the methine proton of the chain is located in the plane of the pyridyl ring. When these polymers are irradiated in glassy concentrated hydrochloric acid, the nitrogens being protonated, hydrogen atom addition occurs to a ring carbon with formation of an azacyclohexadienyl radical. Likewise vinylpyridinyl and methylazabenzyl radicals are formed when vinylpyridine monomers are irradiated in neutral and acidic matrices respectively. The hyperfine coupling parameters determined from these radicals formed in specific conditions, allowed the assignment of the spectra of bulk irradiated polymers to pyridyl and pyridinyl radicals. (auth)

10701 (CONF-721239-P1) PROCEEDINGS OF THE CHEMISTRY SYMPOSIUM, ALIGARH MUSLIM UNIVERSITY, ALIGARH, DECEMBER 21–23, 1972. Volume I. Radioisotope Techniques for Chemical and Biomedical Applications, Nuclear and Radio Chemistry, and Radiation Chemistry. (Department of Atomic Energy, Bombay (India)). 1972. 374p.

The 45 papers and any discussions on these papers are compiled. Separate abstracts were prepared for the papers. (JSR)

For abstracts of individual papers see: 10514–10516, 10557, 10598, 10599, 10624–10626, 10645, 10678, 10728–10743, 10774–10776, 10796–10801, 10833, 10834, 10843, 11264, 11391, 11524, and 12949–12951.

10702 (CONF-741046-(Absts.)) 7th RADIATION CHEMISTRY CONFERENCE, 21st–23rd OCTOBER 1974, LUCAS HEIGHTS, N.S.W. Abstracts of Papers. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). [nd]. 29p.

Abstracts of twenty-eight papers are presented which deal with radiolysis, radiopolymerization, physicochemical events and gases, aqueous systems, organic system and solvated electrons, transient species and monolayers, and inorganic system and oxide surfaces. (AT)

10703 (COO-3435-18) MICROWAVE-OPTICAL DOUBLE RESONANCE SPECTROSCOPY. Progress Report, February 1, 1974–January 31, 1975. Pratt, D. W. (Pittsburgh Univ., Pa. (USA). Dept. of Chemistry). 1 Nov 1974. Contract AT(11-1)-3435. 21p. Dep. NTIS $4.25.

Optical detection of magnetic resonance (ODMR) experiments were performed on the phosphorescent triplet states of several benzenes, naphthalenes, and benzophenones in single crystal hosts at liquid helium temperatures. Direct observation of level anticrossing effects in molecular triplet states is reported for the first time. Several classes of free radicals and paramagnetic species of biological importance were studied by EPR and optical spectroscopy. (auth)

10704 (IAE-2282) RADIATION POLYMERIZATION IN NEUTRAL ORGANO-PHOSPHORIC EXTRACTING AGENTS. Extraction of Radiation Polymers and Investigation Into Certain of Their Physicochemical Properties. Kalinichenko, B. S.; Dedov, V. B.; Vladimirova, M. V.; Trukhlveev, P. S.; Pereverzev, V. S.; Voskresenskii, N. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 16p. (In Russian). INIS.

Questions connected with the processes of radiation polymerization in neutral phospho-organic extracting agents as TBP and DAMPA were examined. A preparative separation of the polymer was made. Some physical-chemical properties of the polymer were studied. A method was developed for the identification of the polymer by paper chromatography. (tr-auth)

10705 (IAEA-R-1040-F) DICARBOXYLIC ACIDS AS CHEMICAL DOSIMETERS. Final Report for the Period 1 July 1971–30 June 1974. Gal, O. (International Atomic Energy Agency, Vienna (Austria)). Jul 1974. vp. INIS.

The radiolytic behavior of dicarboxylic acids and the conditions for their dosimetric use (particularly for in-pile dosimetry) were studied. The usefulness of oxalic and succinic acid for in pile chemical dosimetry are comparable in the range of hundreds of rads at reactor power levels of approximately 5 to 6 megawatts. The method of analysis consists of determining the radiolytic decomposition of the irradiated material by weighing the remaining substance. The radiolysis of succinic acid was demonstrably more complicated and the absence of CO_3^- in the irradiated product was confirmed. An intercomparison of in-pile dosimetry systems was performed relevant to calorimetric dose determinations. The results obtained with the oxalic system demonstrated good accuracy whereas the results with the succinic system were equivocal. LET studies were initiated using Li-oxalate and studying the response of mixed chemical systems subject to the $^6Li\ (n, \alpha)^3H$ reaction. (INIS)

10706 (ORO-2001-33) RADIATION INDUCED EFFECTS IN ORGANIC SYSTEMS. Progress Report, December 1, 1973–December 1, 1974. Johnsen, R. H. (Florida State Univ., Tallahassee (USA)). 1974. Contract AT(40-1)-2001. 13p. Dep. NTIS $4.00.

Specific areas in which work was performed include: (1) radical diffusion studies as a function of temperature in a number of amino acids and a determination of the structure of the stable radical in arginine hydrochloride monohydrate single crystals; (2) chemical effects (product analysis) of P'p'-azoxyanisole irradiated in liquid, meso phase, and crystalline phase for purposes of correlation with ESR studies on these same systems; (3) effects of electrical fields on radiation chemical effects with emphasis on the basic mechanism of this procedure; and (4) a continuation of our efforts to develop a technique for studying the structure of isomeric ions using collision-induced metastability. (auth)

10707 TRIPLET STATES OF UBIQUINONE ANALOGS STUDIED BY ULTRAVIOLET AND ELECTRON NANOSECOND IRRADIATION. Amouyal, E.; Bensasson, R.; Land, E. J. (Univ., Paris). Photochem. Photobiol.; 20: No. 5, 415-422(Nov 1974).

The triplet excited states of four derivatives of ubiquinone-30, in which various ring substituents are progressively altered, have been studied by laser flash photolysis (265 nm) and pulse radiolysis (9-12 MeV electrons). Triplet absorption spectrum, extinction coefficient, lifetime, energy level and quantum efficiency of formation were determined. By comparison with previous studies with ubiquinone-30, it was deduced that the low triplet energy and quantum efficiency of formation of triplet ubiquinone-30 was caused by the presence of the two adjacent methoxy substituents, rather than to be isoprenoid side chain. The low quantum efficiency of triplet formation, although consistent with in vivo ubiquinone photomodification occurring via the triplet, suggested that little of the ubisemiquinone observed in bacterial photosynthesis was formed via excited ubiquinone. (auth)

10708 DESTRUCTION RATE OF Cl_2^- ANION-RADICALS DURING PULSE RADIOLYSIS OF CONCENTRATED AQUEOUS LITHIUM CHLORIDE SOLUTIONS. Zhestkova, T. P.; Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). Bull. Acad. Sci., USSR, Div. Chem. Sci. (Engl. Transl.); 23: No. 4, 877-878 (Apr 1974).

Translated from Izv. Akad. Nauk SSR, Ser. Khim.; 23: No. 4, 913-914(Apr 1974).

The destruction rate of the Cl_2^- anion-radical in irradiated aqueous LiCl solutions was measured. The rate constant of this process in solutions, saturated with oxygen, depends on the dose per pulse, which is explained by the competition of the reactions $Cl_2^- + Cl_2^-$ and $Cl_2^- + O_2^-$. The rate constants of the reaction $Cl_2^- + Cl_2^-$ were determined at various LiCl concentrations and an estimate was made of the upper limiting value of the rate constant of the reaction $Cl_2^- + O_2^-$. (auth)

10709 INFLUENCE OF CYCLIC STRUCTURE ON THE RADIOLYSIS OF HYDROCARBONS. II. Radiolysis of Alkylcyclopentanes and Alkylcyclohexanes. Wojnarvits, L.; Foldiak, G. (Inst. of Isotopes, Budapest). Acta Chim. Acad. Sci. Hung.; 82: No. 3, 285-303(1974).

Products formed via C–H and C–C bond fissions in the vicinity of the tertiary carbon atom of the molecule are predominant in the product spectrum of methyl- and ethylcyclopentane as well as methyl- and ethylcyclohexane irradiated in the liquid phase with ^{60}Co γ radiation. Of the cyclic products 1-methyl and 1-ethylcycloalkenes are produced with highest yield from methyl- and ethylcycloalkanes. Fission of C–C bonds of the ring result predominantly in the formation of isomeric open chain alkenes. The values of $G(H_2)$ are lower and those of G(C–C) are higher in the case of C_5 than C_6 rings. This presumably may be attributed to the fact that strain energy in C_5 rings favours ring fission. (auth)

10710 FREE RADICALS IN γ-IRRADIATED FROZEN SOLUTIONS OF DEOXYADENOSINE-5′-MONOPHOSPHATE. A Computer Analysis of Temperature-Dependent ESR Spectra. Gregoli, S.; Olast, M., Bertinchamps, A. (Univ., Brussels). Radiat. Res.; 60: No. 3, 388-404(Dec 1974).

Deoxyadenosine-5′-monophosphate (dAMP) was irradiated at 77°K in frozen aqueous solution, and then annealed, step by step, until disappearance of any detectable ESR signal. Computer analysis of the qualitative and quantitative transformations undergone by ESR spectra during this process enabled us to postulate a mechanism accounting for radical reactions involving primary and secondary species and to delineate the corresponding pathways. The following mechanism was postulated as being responsible for the experimental data obtained. At 77°K the free radical population formed on dAMP by the direct effect of radiation is mainly composed of adenine anions and cations. Under heat treatment both such adenine ions react with neighboring water molecules to give respectively H-addition and OH-addition radicals on the adenine base group. Addition of the electron scavenger iodoacetamide to the dAMP solution prior to irradiation inhibits the formation of H-addition radicals selectively, by preventing the formation of their anionic precursors. In addition to the base-located free radicals mentioned, another radical species, located on the deoxyribose moiety of dAMP was also detected. Individual temperature kinetics were described for each radical species. (auth)

10711 OPTICAL ABSORPTION SPECTRUM OF THE SOLVATED ELECTRON IN SOME LIQUID AMIDES AND AMINES. Gavlas, J. F.; Jou, F. Y.; Dorfman, L. M. (Ohio State Univ., Columbus). J. Phys. Chem.; 78: No. 25, 2631-2635(5 Dec 1974).

The optical absorption spectrum of the solvated electron has been determined, at room temperature, in several amides and amines. The absorption maxima are found to be as follows: N,N-dimethylformamide, 1680 nm; N,N-dimethylacetamide, 1800 nm; N,N-diethylformamide, 1775 nm; dimethylamine, 1950 nm; 1,2-propanediamine, 1500 nm. The results for these amides are not in accord with an empirical correlation of such data recently proposed by Freeman. The general spectral grouping of the absorption of e_s^- in a variety of liquids with type of compound is discussed. Rate constants have been determined for reactions of e_s^- in ethanol with formamide, N-methylformamide, and N,N-dimethylformamide. The values are respectively 1.8×10^8, 2.2×10^8, and 1.1×10^9 M^{-1} sec^{-1}. (auth)

10712 INTERMEDIATES PRODUCED FROM THE ONE-ELECTRON REDUCTION OF NITROGEN HETEROCYCLIC COMPOUNDS IN SOLUTION. Moorthy, P. N.; Hayon, E. (Army Natick Labs., MA). J. Phys. Chem.; 78: No. 25, 2615-2620 (5 Dec 1974).

A detailed examination of the one-electron reduction of aromatic nitrogen heterocyclic compounds in water was carried out using the technique of pulse radiolysis and kinetic absorption spectrophotometry. The compounds studied include pyrazine (Pz), pyrimidine (Pm), pyridazine (Pd), quinoxaline (Qx), phthalazine, and acridine. The reducing agents used were e_{aq}^-, $(CH_3)_2\dot{C}OH$ and $(CH_3)_2\dot{C}O^-$ radicals. The efficiency and the rate of electron transfer from the latter two radicals were correlated with the redox potentials of the azo-aromatic compounds. The radical anions of these compounds are very weak acids and undergo fast protonation by water or by other proton donors to form the neutral monohydro radicals and the dihydroradical cations. Based on the determined transient absorption spectra of the intermediates, and their change over the pH range 0–14, it was possible to assign and derive the ionization constants of the radical observed. $\cdot PzH_2^+$, $\cdot PmH_2^+$, $\cdot PdH_2^+$, and $\cdot QxH_2^+$ dihydroradical cations the pK_a values are 10.5 ± 0.2, 7.6 ± 0.1, 7.6 ± 0.3, and 8.8 ± 0.1, respectively. No ionization of the corresponding neutral radicals ·PzH, ·PmH, ·PdH, and ·QxH to the radical anions was observed up to pH 14, and presumably occurs only in very alkaline solution. An interesting feature of the spectral characteristics of these intermediates is the blue shifting of the absorption maxima of the neutral monohydro radicals compared to the dihydro radical cations. Furthermore, the radical cations are relatively inert to oxygen while the neutral radicals react with O_2 with $k > 10^9$ M^{-1} sec^{-1}. (auth)

10713 RADIATION-INDUCED DECHLORINATION OF CHLORAL HYDRATE AND 1,1,1-TRICHLORO-2,2-BIS(P-CHLOROPHENYL)ETHANE (DDT). Woods, R. J.; Akhtar, S. (Univ. of Saskatchewan, Saskatoon). J. Agr. Food Chem.; 22: No. 6, 1132-1133(1974).

Chloral hydrate and DDT, present in low concentrations in aqueous media, are dechlorinated by moderate doses of γ-radiation. Oxygen and relatively high concentrations of organic material reduce, but do not completely inhibit, chloral hydrate dechlorination. (auth)

10714 PULSE RADIOLYSIS STUDY OF AQUEOUS HYDROGEN CYANIDE AND CYANIDE SOLUTIONS. Behar, D. (Carnegie-Mellon Univ., Pittsburgh). J. Phys. Chem.; 78: No. 26, 2660-2663(19 Dec 1974).

The pulse radiolysis of N_2O saturated solutions of HCN and CN^- has been studied in the pH region 3.7 to 14. Spectra of three different species were identified. In acid and neutral solutions OH adds to the HCN triple bond and forms the HC(OH)=N radical with λ_{max} 240 nm and ϵ_{240} 550 M^{-1} cm^{-1}. This radical disappears according to a second-order rate law with $2k = 1.5 \times 10^9$ M^{-1} sec^{-1}. At pH 10.6 OH adds to CN^- with a rate of $k(OH + CN^-) = 7.1 \times 10^9$ M^{-1} sec^{-1} to form $HO\dot{C}-N^-$. This adduct protonates and rearranges to the formamide radical $\dot{C}ONH_2$ with λ_{max} <225 nm and ϵ_{225} 1400 M^{-1} cm^{-1}. The second-order rate constant for disappearance of the $\dot{C}ONH_2$ radical is $2k = 6.2 \times 10^9$ M^{-1} sec^{-1}. At pH 14, O^- reacts with CN^- with a rate constant of $k(O^- + CN^-) = 2.6 \times 10^8$ M^{-1} sec^{-1}. The adduct rearranges in the same way as at lower pH to produce $(\dot{C}ONH)^-$ with λ_{max} 245 nm and ϵ_{245} 2200 M^{-1} cm^{-1}. The $(\dot{C}ONH)^-$ decays in a second-order rate $2k = 2.2 \times 10^9$ M^{-1} sec^{-1}. The formamide radical is in acid-base equilibrium with pK $(\dot{C}ONH_2 \rightleftharpoons \dot{C}ONH^- + H^+) = 12.25$. (auth)

10715 SOME THEORETICAL CONSIDERATIONS ON THE CHEMICAL MECHANISM OF THE RADIATION-INDUCED DEPOLYMERIZATION OF HIGH MOLECULAR CARBOHYDRATES. Scherz, H. (Inst. of Radiation Tech., Karlsruhe, Germany). pp 39-50 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

Irradiation of high molecular carbohydrates in the solid state, as well as of their aqueous solutions, causes the breaking of the external ether bridges. Two mechanisms can be assumed which take place simultaneously: (a) Direct action of radiation on the oxygen bridges in the solid state leads to the formation of an -O·- radical; then the -O-C- linkage to the next hexose unit is split off giving a positive ion at C_4 and a glycosyl radical. In aqueous solutions H_3O^+ are formed as primary species with G-values of ~2,8 which would hydrolyse the glycosidic bond according to the mechanism of the normal acid hydrolysis. (b) Irradiation causes – directly or indirectly – alterations of some of the monosaccharide units in the chain molecule by radiation-induced dehydration and β-splitting, forming deoxycarbonyl or deoxyacid groups in the chain. It is not difficult to imagine that the ether bridges of these altered groups show an essentially higher sensitivity towards hydrolysis than the other linkages. In general, it could be stated that irradiation forms "weak points" in the chain molecule. External influences (heating, acid treatment etc.) or further energy transfer will act preferentially at these points and cause the breaking of the carbohydrate chain. (auth)

10716 PHYSICOCHEMICAL CHANGES IN IRRADIATED (GAMMA ^{60}Co) INULIN. Bachman, S.; Zegota, H. (Univ., Lodz, Poland). pp 61-75 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

The effect of gamma ^{60}Co rays on the formation (radiolysis) of major products of inulin when irradiated in aqueous solution and in the solid state was investigated. In both cases processes were found to occur that lead to the degradation of inulin molecules to smaller fragments. Among the products of inulin radiolysis detected were: deoxysugars, formaldehyde, oxalic acid, and substances absorbing between 220 and 320 nm. The use of thin-layer chromatography established the presence of fructose, glucose, and sucrose. The intermediate products of inulin radiolysis are free radicals that form with the yield $G_{radical}$ = 5.5 in de-aerated inulin and $G_{radical}$ = 0.45 in the presence of air. The ESR spectra obtained for inulin resemble those obtained for fructose which points to the similar character of the radicals forming in both cases. The presence of oxygen during inulin irradiation enhances the contribution of oxidative processes leading to the formation of organic acids. (auth)

10717 EFFECTS OF IONIZING RADIATION ON GELATIN IN THE SOLID STATE. Bechman, S.; Galant, S.; Gasyna, Z.; Witkowski, S.; Zegota, H. (Univ., Lodz, Poland). pp 77-94 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

The effect of gamma ^{60}Co radiation on some technological and physico-chemical properties of gelatin irradiated in the solid state was investigated. Doses of up to 2.5 Mrad did not give rise to any negative changes in irradiated gelatin. Doses between 0.5 and 1.0 Mrad were sufficient to sterilize gelatin with insignificant surface contamination. The effect of radiation between 0.5 and 3.5 Mrad on degradation of gelatin molecules and increase in polydispersity was demonstrated on the basis of studies on viscosity and molecular sieving on Sepharose 4 B gel, as well as by determinations of sedimentation velocity constant and optical rotatory dispersion. Irradiation of gelatin did not produce any distinct changes in amino acid composition though it did give rise to an increase in the content of carbonyl groups. Ionizing radiation induced the formation of free radicals, producing ESR spectra in the form of a symmetrical doublet. The kinetics of free-radical decay in gelatin while stored at room temperature in the presence of air were also studied. The studies performed may serve as evidence and arguments in favor of legalizing the process of radiation sterilization of gelatin. (auth)

10718 THE ANTIOXIDATIVE EFFECTS OF GAMMA-IRRADIATED AMINO-SUGAR REACTION PRODUCTS. Fujimaki, M.; Morita, M.; Kato, H. (Tokyo Univ.). pp 95-99 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

Experiments were carried out on the products from the gamma-irradiated amino acid-sugar reaction. It is shown that the antioxidative activity of melanoidin is not much affected by the irradiation. The development of the antioxidative activity of the amino acid-sugar solution on heating was markedly accelerated when the solution was pre-irradiated. Pre-irradiation of just the sugar solution accelerated the development of the antioxidative activity, as was not the case when the amino acid solution alone was pre-irradiated. With one exception, all combinations of amino acids with sugars gave almost the same antioxidative results. (auth)

10719 POLYHYDROXY-BIS-OXAZOLINE UNSATURATED ESTERS, THEIR PREPARATION AND THEIR USE. Mileo, J. C.; Sillion, B. (to Institut Francais du Petrole). French Patent 2,176,192. 13 Mar 1972. 13p. (In French).

The invention relates to novel polyhydroxy-bis-oxazoline unsaturated esters, their preparation and their use. These esters are more especially derived from di- or tetra-hydroxy-bis-oxazolines through esterification of two or more of their hydroxy functions by one or several unsaturated monocarboxylic acids (e.g., acrylic and methacrylic acids). The admixtures of these esters with at least one mono- or polyfunctional polymerizable unsaturated monomer and/or various resins or plastifiers can be used in particular for preparing varnishes, lacquers and paints which can be preferably hardened by an electron beam. (FR)

10720 NEW COMPOUNDS TO BE USED IN THE PREPARATION OF COATING COMPOSITIONS. Mileo, J. C.; Sillion, B.; de Gaudemaris, G. (to Institut Francais du Petrole). French Patent 2,174,360. 29 Feb 1972. 12p. (In French).

The present certificate of addition relates to new compounds to be used in the preparation of irradiation hardened coating compositions. The compounds according to the present addition are derived from tetrahydroxylated bis-oxazolines through the substitution of urethane chains terminating in α-β ethylenic unsaturated groups for at least two of their hydroxyl groups. These compounds can be obtained through mono-addition reaction of a mobile hydrogen vinylic compound on a di-isocyanate followed by the reaction of the thus obtained derivative on at least two of the hydroxyl functions of tetrahydroxylated bis-oxazoline. The compounds thus obtained can copolymerize with unsaturated monomers in particular by means of an average energy electron beam, whereby they can be used for preparing hardenable coatings, in particular as varnishes or as binding agents for paints. (FR)

10721 NEW COMPOSITIONS FOR RADIATION-HARDENED COATINGS. Mileo, J. C.; Sillion, B. (to Institut Francais du Petrole). French Patent 2,168,623. 17 Jan 1972. 12p. (In French).

The invention relates to new compositions for radiation-hardened coatings. These compositions are characterized in that they contain a styrene allyl alcohol copolymer modified by vinyl-unsaturated urethane chains, at least one copolymerizable vinyl monomer and contingently at least another saturated or unsaturated resin. These compositions preferably hardened by radiations in particular by means of an average energy electron beam can be used in particular for preparing varnishes, lacquers and paints and lamellar or moulded objects. (FR)

10722 COMPLEX FORMATION IN THE SYSTEMS HNO_3 – HDBP AND HNO_3 – H_2MBP. Kozlowska-Milner, E. (Inst. of Nuclear Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 9, 793-800(Nov 1974).

The frozen binary systems HNO_3 – HDBP and HNO_3 – H_2MBP irradiated in a ^{60}Co source (at 77°K) were investigated by the ESR method. On the basis of a previously elaborated method of the determination of the maximum coordination number of the complexes formed in the frozen HNO_3 – organic solvent systems the following hitherto unknown complexes of a composition (HDBP · $3HNO_3$) and (H_2MBP · $2HNO_3$) were detected. The results obtained indicate the participation of ester oxygen P – O – C in the complexing of nitric acid under conditions of the frozen binary mixtures of HNO_3 – TBP, HNO_3 – HDBP and HNO_3 – H_2MBP. The radiolysis processes occurring at different concentrations of the binary mixtures studied were described. (auth)

10723 CALCULATION OF PRODUCTION CAPACITY OF RADIATION – CHEMICAL REACTOR FOR LIQUID-PHASE CHAIN REACTIONS. Poluektov, V. A. Dokl. Chem. Technol. (Engl. Transl.); 214-216: 85-88(1974).

Translated from Dokl. Akad. Nauk SSSR; 216: No. 4, 378-381 (May 1974).

The best reactor for liquid-phase chain reactions is a cylindrical vessel with a linear gamma source located along the axis. Equations are derived for calculating the reactor output; the accurate calculation is equal to the output based on average dose rate within 10%. The reactor volume and dimensions can also be calculated. Results were applied to the oxidation of liquid trichloroethylene by oxygen; the calculated output was 11.5% below the observed output. (DLC)

10724 RADIATION CHEMISTRY OF CARBOHYDRATES. XVI. Isolation of Products of the Radiolysis of Glucosamine and N-acetylglucosamine, and the Establishment of Their Structures. Kudryashov, L. I.; Senchenkova, T. M. J. Gen. Chem. USSR (Engl. Transl.); 44: No. 6, 1363-1366(Jun 1974).

Translated from Zh. Obsch. Khim.; 44: No. 6, 1389-1393(Jun 1974).

The main products of the radiolysis of glucosamine are arabinose and glyceraldehyde. The G yields of these compounds were determined and compared with the consumption of glucosamine in the radiation-chemical process. In the radiolysis of glucosamine and N-acetylglucosamine products of identical structure are formed, which may indicate the like characters of the transformation processes of these compounds. One process occurring in the radiolysis of N-acetylglucosamine is deacetylation, leading to the formation of glucosamine. (auth)

10725 RADIATION CHEMISTRY OF CARBOHYDRATES. XVII. Chemical Changes in Aqueous Solutions of Laminarin Under the Action of γ-Radiation. Kudryashov, L. I.; Yarovaya, S. M.; Zvyagintseva, T. N.; Kochetkov, N. K. J. Gen. Chem. USSR (Engl. Transl.); 44: No. 6, 1367-1371(Jun 1974).

Translated from Zh. Obsch. Khim.; 44: No. 6, 1393-1398(Jun 1974).

In irradiation of aqueous solutions of laminarin there occur both the degradation of the polymer and also its damage without change in molecular weight, consisting in the formation of new reducing groups, deoxy and deoxy keto groupings, and acids. Investigation of the properties of polymers irradiated with different doses showed that they lose to a large extent their ability to be split by a specific enzyme (exo-laminarase). (auth)

10726 CARBON SOURCES AND FORMATION MECHANISMS OF ORGANIC IODIDES IN NITRIC ACID SOLUTIONS. Saeki, M.; Numakura, K.; Tachikawa, E. (Japan Atomic Energy Research Inst., Ibaraki). Int. J. Appl. Radiat. Isotop.; 25: No. 9, 407-414(Sep 1974).

Organic iodides, such as CH_3I, C_2H_5I, $n\text{-}C_3H_7I$ and $n\text{-}C_4H_9I$ were formed either by heating the HNO_3 solutions containing carrier-free ^{131}I or by irradiating the solutions with γ-rays. The possibility of CO_2 as a carbon source for the organic species has been examined by means of a radioisotope dilution method. The results obtained, with those on the addition of various carbon compounds, indicate that an important carbon source is high molecular-weight organic compounds, which are mostly contained in HNO_3 as an impurity. Furthermore the information obtained by the purification of HNO_3, and by replacing the flushing gas, He, by O_2, reveals that the organic iodides are formed by radical reactions of the organic species which result from fragmentation of organic compounds with $^{131}I^0$. (auth)

10727 EFFECT OF X-IRRADIATION ON THE LATTICE CONSTANT OF TGS CRYSTAL IN THE VICINITY OF PHASE TRANSITION. Stepien-Damm, J. A.; Suski, T.; Meysner, L.; Hilczer, B.; Lukaszewicz, K. (Inst. for Low Temperature and Structure Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 8, 685-688(Oct 1974).

Using the Bond technique precise measurements of x-ray-induced changes of the lattice constant b in TGS crystals were examined. Radiolysis of TGS results in either lowering or raising constant b in ferroelectric or paraelectric phase, respectively. Moreover, with increasing radiation dose the phase transition temperature (T_c) shifts towards lower values and undergoes significant diffusion. The irradiation of ferroelectric crystals at constant temperature, sufficiently close to T_c, induces the transition to paraelectric phase. (auth)

10728 RADIATION-INDUCED LUMINESCENCE IN BENZENE AND CYCLOHEXANE MATRICES AT LOW TEMPERATURES. Bhadra, S.; Srivastava, S. B.; Mozumder, A. (Bhabha Atomic Research Centre, Bombay). pp 267-271 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effect of the electron scavenger ethyl bromide on the luminescence of γ-irradiated pure benzene, benzene solutions with PPO, and cyclohexane solutions with PPO was studied and compared. For pure benzene and benzene solutions the luminescent intensity initially decreased as the temperature increased from 70 to 300°K. In the case of pure benzene the intensity was constant over the plateau region of the temperature profile, but a minimum was observed in the benzene solutions and then the intensity steadily increased with increasing temperature. In the presence of ethyl bromide in benzene solutions the initial luminescence decreased with increase of temperature. In the case of cyclohexane solutions the luminescent intensity increased with increase in temperature without any minimum. (JSR)

10729 γ RADIOLYSIS OF CH_3I IN 3-METHYLPENTANE GLASSY MATRIX AT 77°K AND THE EFFECTS CAUSED BY ITS AGGREGATION. Saha, S. K.; Iyer, R. M. (Bhabha Atomic Research Centre, Bombay). pp 273-279 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The formation of CH_3I aggregates in 3-methylpentane at 77°K and the role of clustering of CH_3I molecules in the γ radiolysis of CH_3I–3-methylpentane glass at 77°K were studied. Various concentrations of CH_3I in 3-methylpentane were prepared under vacuum, either quickly or slowly frozen to induce variable aggregation, and then γ-irradiated at 77°K. The results showed that slowly frozen samples yield more iodine than quick-frozen samples, but $G_{(CH_4)}$ and $G_{(CH_3)}$ is higher for quick-frozen samples than slow-frozen. The decay of the CH_3 radical was unaffected by the freezing rate. These results indicate that CH_3I aggregates in the 3-methylpentane and the final product yield depends on the size and number of solute clusters. The sequence of ionic events in the system is given. G values indicate that the probability of the hot CH_3 radical to abstract hydrogen atoms from the matrix or to displace one H atom from the matrix producing isoheptane is almost equal. Analysis of the $(^{\circ}CH_3)_T$ decay indicates that the recombination of CH_3 radical with I seems to be the path for its decay. The data indicate that the CH_3I molecules are aggregated in a large number of small clusters rather than in a small number of large clusters. (JSR)

10730 RADIATION CHEMISTRY OF TRIPHENYLBISMUTHINE IN A MIXTURE OF BENZENE AND CYCLOHEXANE. Nazir, S. B.; Rai, R. S. (Riral Inst. of Tech. and Science, Pilani, India). pp 281-286 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The protective effects of benzene against the radiolysis of cyclohexane are well known. The effect of triphenylbismuthine on this protective effect was studied. The radiolysis products of mixtures of benzene and cyclohexane, benzene and triphenylbismuthine, cyclohexane and triphenylbismuthine, and benzene, cyclohexane, and triphenylbismuthine exposed to γ radiation were determined by chromatography. The radiolysis of benzene and cyclohexane formed pentane, two isomers of hexane, hexene, and methylcyclopentane. The radiolysis of the three-component mixture showed that the yield of the first and second isomers of hexane are unaffected by the triphenylbismuthine, but the formation of hexene is completely inhibited and the yield of methylcyclopentane is increased. With increasing percentage of benzene the pentane yield and the first hexane isomer yield decreased. The second isomer of hexane is not formed at high benzene concentrations and the methylcyclopentane yield decreases continuously with increasing benzene concentrations. It is concluded that cyclohexane is protected against γ radiation when benzene is present in concentrations of 40 to 50% and the triphenyl concentration is 0.95×10^{-2} M. Mechanisms for the formation of hexene and methylcyclopentane are proposed. (JSR)

10731 GAMMA RADIOLYSIS OF CYCLOHEXANE IN PRESENCE OF TRIPHENYLPHOSPHINE. Chand, N.; Rai, R. S. (Riral Inst. of Tech. and Science, Pilani, India). pp 287-290 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effect of the addition of cyclohexane on the γ radiolysis products of triphenylphosphine was studied and an attempt was made to suggest a mechanism for their formation. The major radiolysis products of pure cyclohexane were benzene and cyclohexene. The γ irradiation of triphenylphosphine in cyclohexane showed hydrocarbons of the C-5 family, hexane, methycyclopentane, cyclohexane, benzene, and cyclohexene. The G values of C-5, hexane, methylcyclopentane, and hexene increase with increasing concentrations of the triphenyl and reached a plateau, whereas the G values of cyclohexene and benzene decreased with increasing triphenyl concentrations. The G values of hexane, hexene, methylcyclopentane, and benzene decreased with increasing dose. The addition of PPO decreased the G values of hexane, benzene, cyclohexene, methylcyclopentane, and hexane with increasing concentrations of the scintillator. On the basis of this radiolysis products mechanisms were proposed for the formation of hexene and methycyclopentane. The decrease of radiolysis products with increasing dose was attributed to the formation of radical scavengers. (JSR)

10732 HYDROXYL RADICAL REACTIONS IN THE RADIOLYSIS OF AQUEOUS NITRIC ACID. Bhattacharyya, P. K.; Saini, R. D. (Bhabha Atomic Research Centre, Bombay). pp 291-295 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The addition of sulphanilamide (SA) to aqueous HNO_3 solutions was shown to inhibit the reaction between the two primary radiolysis products of HNO_3–HNO_2 and H_2O_2. The role of the OH radical in affecting the yield of HNO_2 in the presence of SA and its reaction with SA during γ radiolysis of aqueous HNO_3 solutions with and without isopropyl alcohol at a dose rate of 2.36×10^{17} eV g^{-1} min^{-1} was studied. Possible reactions of OH in the radiolysis were discussed. It is concluded from the present study that almost all the OH radicals are scavenged by ROH resulting in an increase in the yield of HNO_2. The rate constant $k_{(OH+SA)}$ was determined to be of the order of 3.85×10^9 M^{-1} sec^{-1}. (JSR)

10733 RADIOLYSIS OF AQUEOUS SOLUTIONS OF TMPD (TETRAMETHYL-P-B-PHENYLENE DIAMINE): ITS POSSIBLE USE FOR TRAPPING THE POSITIVE HOLES IN THE RADIOLYSIS OF WATER. Prasad, D.; Mittal, J. P.; Shankar, J. (Bhabha Atomic Research Centre, Bombay). pp 297-302 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The γ radiolysis of TMPD (tetramethyl-p-b-phenylene diamine)

in aqueous solution was studied in order to evaluate its potential for trapping positive holes in the radiolysis of water. The G value of $TMPD^+$ was determined when various electron scavengers were used. The results suggest that the positive holes H_2O^+ or even dry H_3O^+ are trapped. Evidence to prove that the production of $TMPD^+$ is due to trapping and not by the reaction of OH radicals is cited. (JSR)

10734 ^{60}Co-GAMMA RADIOLYSIS OF CYSTEINE IN AERATED AND OXYGEN SATURATED 1N $HClO_4$ SOLUTIONS. Lal, M. (Bhabha Atomic Research Centre, Bombay). pp 303-309 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The γ radiolysis of cysteine in aerated and oxygen-saturated 1N $HClO_4$ solutions was studied. The G values of the primary products were determined and were higher than the corresponding values for deaerated solutions. The reaction sequence for the radiolysis is proposed. The G value of -CySH was calculated on the basis of this mechanism and was in excellent agreement with the experimental value. Both G(CyS-SCy) and $G(H_2O_2)$ vary inversely with the square root of the radiation intensity, which confirms the mechanism suggested. (JSR)

10735 ESR STUDY OF OXYGEN CONTAINING PARAMAGNETIC SPECIES FORMED IN γ-IRRADIATED FROZEN AQUEOUS ALKALI HYDROXIDE MATRICES. Moorthy, P. N.; Rao, K. N.; Mishra, K. P.; Singh, B. B. (Bhabha Atomic Research Centre, Bombay). pp 311-320 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Frozen aqueous alkali hydroxides show a broad asymmetric ESR spectrum after γ irradiation at 77°K followed by annealing at 178°K. The nature of the species responsible for this spectrum was studied on N_2-purged, aerated, or O_2-purged 2M NaOH exposed to γ radiation at 77°K and annealed to 113°K. The ESR signal was attributed to O_2^-. Warming the samples to 178°K produced a broader ESR spectrum whose intensity was negligible in the N_2-purged matrix and maximum in the O_2-purged matrix. In order to determine the nature of the species causing this broad spectrum various electron scavengers were used. The radiation-produced electrons are trapped both by a shallow trapping which gives a blue color and symmetric ESR signal and a deep trapping with no observable color and no previously detected ESR signal. The shallow-trapped electrons are easily scavenged. The deep-trapped electrons are not readily scavenged and are attributed to Na^+_{aq}, e^-. Therefore that species formed on warming the oxygen-containing matrix can be interpreted as $Na^+_{aq}\ O_2^-$, which can interact to some extent with a hydrated alkali metal cation. The O_2^- species formed during photobleaching does not interact. (JSR)

10736 RADIOLYSIS OF COBALT HEXAMINE NITRATE IN POTASSIUM BROMIDE MATRIX. Thomas, V. G.; Srivastava, S. B. (Bhabha Atomic Research Centre, Bombay). pp 321-325 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The solid-state radiolysis of cobalt hexamine nitrate in potassium bromide matrix was studied in the absence of oxygen at 77°K for ^{60}Co γ radiation. The nitrite yields were determined as a function of KBr concentration. The results showed that the nitrate decomposition increases linearly with the concentration of KBr up to about 10% complex–90% KBr and then there is a sharp increase. Thermal annealing of the γ-irradiated pure complex and mixtures containing 90% and 99% KBr caused a considerable decrease ~70% in the nitrite yield for the pure complex but had almost no effect on the 99% KBr mixture. The effect of oxygen on the radiation decomposition sensitized by the KBr matrix was studied. Oxygen had no effect on the decomposition of the nitrate ion in the pure complex, in the 1% complex mixture the percentage decomposition reached a saturation value for the higher radiation doses. In the evacuated samples the decomposition was about ~35% higher in the high dose range, which showed that the presence of oxygen inhibited the radiation decomposition of the nitrate ions at high radiation doses. (JSR)

10737 RADIATION-INDUCED GRAFTING OF ACRYLIC ACID AND METHACRYLIC ACID ON TO POLYESTER(TERYLENE) FIBERS. Rao, K. N.; Rao, M. H.; Moorthy, P. N.; Charlesby, A. (Bhabha Atomic Research Centre, Bombay). pp 327-332 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The γ radiation-induced grafting of acrylic acid and methacrylic acid to polyester fibers in aqueous solution was studied using various OH and H radical scavengers to prevent homopolymerization. The results showed that the initiating species for homopolymerization are the H atom adducts and not the OH adducts. $CuSO_4$, NO_2^-, $Fe(CN)_6^{3-}$, CrO_4^-, and $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ (H radical scavengers) all efficiently prevented homopolymerization in acrylic acid solutions up to a dose of 1 Mrad, but Fe^{3+} did not prevent homopolymerization in methacrylic acid solutions even at 0.1 Mrad. Effects of total irradiation dose and monomer concentration were determined for $FeSO_4$ and $CuSO_4$ scavengers. The calculation of the dose rate exponent showed that solution grafting in the presence of retarders and vapor phase grafting have the same polymerization characteristics. (JSR)

10738 ELECTRICAL PROPERTIES OF RADIATION-PROCESSED WOOD–POLYMER COMPOSITES. Adur, A. M.; Nigam, S. K.; Patil, N. D. (Bhabha Atomic Research Center, Bombay). pp 333-339 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The water absorption characteristics and dc insulation characteristics of wood impregnated with either styrene–polyester (80:20) or styrene–acrylonitrile (60:40) monomer systems and then exposed to γ irradiation for a total dose of 2.8 and 2.0 Mrads, respectively, were studied. The water absorption characteristics of the two composites were almost the same and showed that as the polymer loading increases the water absorption decreases. Increasing the polymer loading of the wood increased the electrical resistance and the resistance was higher for dry samples than for wet samples. Potential applications of wood–polymer systems were discussed. (JSR)

10739 THERMOLUMINESCENCE (TL) STUDIES IN γ-IRRADIATED TEFLON. Sen Gupta, S.; Sarup, S. (Bhabha Atomic Research Centre, Bombay). pp 341-346 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effects of dose, irradiation temperature, and atmosphere on the thermoluminescence of γ irradiated teflon were studied. Three peaks were observed in the thermoluminescence glow peaks, the first of which is attributed to pre-existing traps on the surface of the teflon and the other two are attributed to peroxide radicals formed by the irradiation. If the samples were irradiated at –196°C in air and heated to room temperature, three thermoluminescence peaks were observed at –96°, –138°, and –184°C. These peaks correspond to shallow traps which can not exist at room temperature. Samples were irradiated in vacuum, N_2, and air at 30°C. One peak was found at ~125°C in the vacuum and N_2 irradiated samples and was not present in the air irradiated samples. A peak at ~150°C was obtained in the air irradiated samples and did not appear in the vacuum and N_2 irradiated samples. It is therefore apparent that the ambient atmosphere has considerable influence on the thermoluminescence glow curves of teflon. (JSR)

10740 RETENTION OF ^{76}As IN (n,γ) IRRADIATED SODIUM ARSENATE. Arnikar, H. J.; Dedgaonkar, V. G.; Barve, M. (Univ. of Poona, India). pp 347-351 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effects of γ radiation and heat treatments following neutron irradiation of solid and aqueous solutions of sodium arsenate were studied in an attempt to understand the radiation and thermal annealing of the recoil ^{76}As embedded in the crystal lattice or dispersed in the solution. As(III) and As(V) were precipitated and the retention values were determined. The results show that As(V) is reduced to As(III) during the recoil after (n,γ) reaction in both the solid and solution states. Both thermal and γ annealing (the γ radiation coming from ^{60}Co source on Sb–Be source) oxidizes the lower oxidation state to the higher. The retention was calculated as 72% for the Sb–Be neutron source which was about 10% higher than that calculated for the Pu–Be source. The mechanism for the recombination of recoil As(III) in both the crystalline and solution states is proposed. (JSR)

10741 ANNEALING IN IRRADIATED POTASSIUM PERCHLORATE. Das, B. K.; Mohanty, S. R. (Utkal Univ., Bhubaneswar, India). pp 353-356 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Potassium perchlorate was irradiated with ^{60}Co γ rays at room

temperature and exposed to isothermal annealing in air at temperatures from 100 to 180°C. The Cl^- and ClO_2^- were determined. The data on the kinetics of isothermal annealing of chlorite are presented. These show that the chlorite annealing is a combination of one first order and one second order process, with the first order process being completed before the second order process begins. There was no appreciable change in the Cl^- concentration during the annealing. (JSR)

10742 PHOTOANNEALING OF CHLORITE IN γ-IRRADIATED POTASSIUM CHLORATE. Mohanty, S. R.; Pandey, V. M. (Utkal Univ., Bhubaneswar, India). pp 357-361 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Potassium chlorate crystals were irradiated with ^{60}Co γ rays at a dose rate of 0.83 Mrad/hr. The irradiated and unirradiated samples were illuminated with light from a W filament lamp. The photoannealing of γ-induced chlorite was determined as a function of time. The results showed that it is a first order process. No substantial recovery was noted for irradiated crystals kept in the dark. Annealing increases linearly with increase in the effective mean frequency of the light. A mechanism for the photo-induced recovery is suggested. (JSR)

10743 THERMAL DECOMPOSITION OF IRRADIATED CALCIUM FORMATE. Ray, M. N.; Sinnarkar, N. D. (Nagpur Univ., India). pp 363-368 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The thermal decomposition of calcium formate in vacuum and the effect of γ radiation on the kinetics of the thermal decomposition were studied. The decomposition was followed by measurement of the total gas pressure developed during the thermal decomposition. The radiation decomposition was determined from the amount of formaldehyde produced. The kinetics for the isothermal decomposition of both non-irradiated and irradiated samples were determined. The results show that irradiation increases the decomposition rate. The mechanism responsible for this increase is discussed. (JSR)

10744 GAS CHROMATOGRAPHIC-MASS SPECTROMETRICAL INVESTIGATIONS OF IRRADIATED OR HEATED FATS, OILS AND MODEL SUBSTANCES. P. 2. Hydrocarbons from Lard, Coconut Fat, Sunflowerseed Oil, Olive Oil and Methyl Linoleat. Drawert, F.; Beck, B. (Technische Univ. Muenchen, Weihenstephan (F. R. Germany). Inst. fuer Chemisch-Technische Analyse und Chemische Lebensmitteltechnologie). Z. Lebensm.-Untersuch. Forsch.; 155: No. 5, 282-286(Aug 1974). (In German).

2 tabs.; 5 refs. Part of a thesis by Beck, B.

After irradiation with a dose of 6 Mrad to lard, coconut fat, sunflower seed oil and olive oil, respectively, after heating these products for 24 hrs at 170°C, 15 saturated, 26 unsaturated aliphatic hydrocarbons, and 4 alkyl cyclohexenes were isolated and identified by gas chromatography-mass spectrometry. The degradation products after irradiation and heating are the same in glycerides that contain saturated fatty acids. Only by the presence of unsaturated fatty acids in coconut fat, for example, is it possible to differentiate qualitatively between irradiation and heating. Proportionality is exhibited between the amounts of degradation products obtained and the applied doses of irradiation. These compounds were investigated in comparative tests after the irradiation of lard by the application of doses of 0.5, 3, and 6 Mrad, respectively. (GE)

10745 INVESTIGATIONS OF IRRADIATED OR HEATED FATS, OILS, AND MODEL-SUBSTANCES BY GASCHROMATOGRAPHY-MASS-SPECTROMETRY. P. 3. Hydrocarbons in Smoked Ham. Drawert, F.; Beck, B. (Technische Univ. Muenchen, Weihenstephan (F. R. Germany). Inst. fuer Chemisch-Technische Analyse und Chemische Lebensmitteltechnologie). Z. Lebensm.-Untersuch. Forsch.; 156: No. 1, 20-21(Sep 1974). (In German).

1 tab.; 4 refs. Part of a thesis by Beck, B.

The outer layers of smoked ham contain the alkanes nonane to octadecane and the alkenes nonene to octadecene, as shown by gas chromatography-mass spectrometry. (auth)

10746 METHOD FOR CROSS-LINKING COPOLYMER OF TETRAFLUOROETHYLENE AND PROPYLENE BY IONIZING RADIATION. Tabata, Y.; Kojima, G. (to Japan Atomic Energy Research Inst.). US Patent 3,846,267. 5 Nov 1974. Priority date 30 Dec 1970, Japan. 10p.

A copolymer of tetrafluoroethylene-propylene is irradiated with high-energy ionizing radiation in the presence of an allyl group-containing compound, an amine, a basic oxide, a free radical initiator, or a free-oxygen releasable oxidizing agent, as a cross-linking accelerator. (Official Gazette)

10747 METHOD OF RADIATION CROSS-LINKING OLEFIN POLYMERS CONTAINING ACRYLATE CROSS-LINKING PROMOTERS. Atchison, G. J.; Sundquist, D. J. (to The Dow Chemical Co.). US Patent 3,852,177. 3 Dec 1974. Filed date 2 Oct 1972. 8p.

A cross-linked olefin polymer is produced by applying high energy ionizing radiation to a mixture of the olefin polymer and a cross-link promoter such as trimethylolpropane triacrylate in an amount such that the mixture absorbs a radiation dose of between about 0.1 and about 1 megarad. The cross-link promoter serves to enhance the cross-linkability of the olefin polymer such that a high degree of cross-link is achieved with a small radiation dose. The mixture can also contain a foaming agent which can be made to expand and thereby produce a cellular product. Products fashioned of the cross-linked polymer have improved dimensional stability and are more resistant to thermal shrinkage and distortion. The cross-linked olefin polymer can be fashioned into a variety of products having utility in many fields including the packaging and construction industries. (Official Gazette)

10748 RADIATION GRAFTING OF ACRYLIC MONOMERS ONTO PERHALOGENATED OLEFIN POLYMERIC SUBSTRATES. Chapiro, A.; Seidler, P. (to L'Agence Nationale De Valorisation De La Recherche). US Patent 3,839,172. 1 Oct 1974. Priority date 25 Jun 1963, France. 8p.

Novel method of making a semi-permeable membrane having a perhalogenated olefin substrate by grafting onto such substrate-acrylic acid or other hydrophilic acid groups is described. The grafting is accomplished by forming a grafting medium comprising water, olefinically unsaturated hydrophilic acid moiety and an inorganic polymerization inhibitor for the homopolymerization of said hydrophilic acid which is a salt of a polyvalent metal; immersing perhalogenated olefin polymer substrate in the grafting medium; and then subjecting such to ionizing radiation sufficient to cause grafting of said hydrophilic acid onto said perhalogenated olefin polymer substrate. (Official Gazette)

10749 PROCESS FOR CURING HYDANTOIN-CONTAINING POLYACRYLATES WITH IONIZING RADIATION. Garratt, P. G.; Habermeier, J; Porret, D.; Leumann, E.; Zuppinger, P. (to Ciba-Geigy AG). US Patent 3,847,769. 12 Nov 1974. Priority date 9 Jul 1971, Switzerland. 18p.

A process for curing polyacrylates, especially in the form of thin layers or coatings, by means of ionizing rays (for example, electron beams, x rays or gamma rays) is described. The resulting coatings show improved weathering resistance, extensibility and gloss retention. (Official Gazette)

10750 FRACTURING WITH RADIATION-INDUCED POLYMERS. Knight, B. L.; Rhudy, J. S.; Gogarty, W. B. (to ICI America Inc.). US Patent 3,841,402. 15 Oct 1974. Filed date 6 Nov 1972. 12p.

Improved fracturing with water-containing fracturing fluids is obtained by incorporating into the water phase of the fracturing fluid a polymer, preferably water-soluble, obtained as a product of radiation-induced polymerization of acrylamide, methacrylamide, acrylic acid, methacrylic acid, alkali metal salts thereof or mixtures thereof. Preferably, the polymer is a copolymer. The polymerization is preferably carried out in 10–60% aqueous monomer solution with gamma radiation. The mixture of monomers, before radiation, preferably contains 25–99% acrylamide and 75–1 percent sodium acrylate. Other additives may be incorporated into the fracturing fluid to impart desired properties. (Official Gazette)

10751 ENDOR STUDIES OF THE SUPERHYPERFINE COUPLINGS OF HYDROGEN–BONDED PROTONS. III. PROTONATED RADICAL ANIONS IN IRRADIATED L-VALINE HYDROCHLORIDE MONOHYDRATE. Muto, H.; Nunome, K.; Iwasaki, M. (Government Industrial Research Institute, Nagoya, Hirate, Kita, Nagoya, Japan). J. Chem. Phys. 61: No. 12, 5311-5314 (15 Dec 1974).

The so–called carboxyl radical anion trapped in irradiated single crystals of L-valine hydrochloride monohydrate has been studied by ENDOR. The spectra exhibited two OH_β proton couplings, indicating that the anion is protonated to form a radical of the type $R-C(OH)_2$. The coupling tensors and their orientations clearly indicate that the amino proton in the neighboring NH_3 group is transferred to the anion through the intermolecular hydrogen bond. Combining the results with those previously obtained for L–alanine and succinic acid, the variation of the dipolar tensor elements with the isotropic values has been examined for the OH_β proton couplings in this type of radical. It is then shown that the anisotropic coupling is approximately independent of the dihedral angle of the $O-H_\beta$ bond. The dipolar

tensors were also calculated as a function of the dihedral angle, and the results are in good agreement with the observations. (auth)

10752 ENDOR STUDIES OF THE SUPERHYPERFINE COUPLINGS OF HYDROGEN–BONDED PROTONS. IV. CARBOXYL RADICAL ANIONS IN IRRADIATED GLYCINE AND α–AMINO ISOBUTYRIC ACID. Iwasaki, M.; Muto, H. (Government Industrial Research Institute, Nagoya, Hirate, Kita, Nagoya, Japan). J. Chem. Phys. 61: No. 12, 5315-5320 (15 Dec 1974).

The carboxyl radical anions trapped in irradiated single crystals of α–glycine and α–amino isobutyric acid have been studied by ENDOR. To elucidate the controlling factors for the selective proton transfer from the neighboring NH_3 groups to the anion across the hydrogen bridge, the superhyperfine coupling tensors of the protons in the neighboring NH_3 groups have been determined. The results suggest that two of the three amino protons hydrogen bonded to the COO group of the anion are located in the middle of the hydrogen bridge or jumping between the nitrogen and oxygen atoms. The latter interpretation seems to be more probable. The remaining one is located in the neighboring NH_3 group. The following controlling factors suggested in our previous paper were confirmed by comparing the results with the reported crystallographic data: firstly, the protons participating in the hydrogen bond, which is formed in the direction of the unpaired electron orbital of the anion, are easily transferred to the anion side; and secondly, the hydrogen bond distance which is shorter than the others is favorable for the transfer. (auth)

10753 PROCESS FOR RECOVERING HYDROCARBON USING POLYMER OBTAINED BY RADIATION POLYMERIZATION. Restaino, A. J.; Bristowe, W. W. (to ICI America Inc.). US Patent 3,841,401. 15 Oct 1974. Filed date 6 Nov 1972. 14p.

Improved waterflooding of an oil-bearing subterranean reservoir is obtained by flooding with a water-soluble polymer obtained as a product of radiation-induced polymerization of acrylamide and/or methacrylamide and acrylic acid, methacrylic acid, and/or alkali metal salts thereof. The polymerization is preferably carried out in 10 to 60% aqueous monomer solution with gamma radiation. The mixture of monomers, before radiation, preferably contains 25 to 99% acrylamide and 75 to 1% sodium acrylate. Such polymers are useful as mobility and/or viscosity control agents. A miscible or miscible-like displacing slug can precede injection of the polymer. (Official Gazette)

10754 ELECTRON SPIN RESONANCE STUDIES OF γ-IRRADIATED CELLULOSE. I. Free Radicals in Decrystallized Cellulose. Shimada, M. (Gunma Univ., Kiryu, Japan); Nakamura, Y.; Kusama, Y.; Matsuda, O.; Tamura, N.; Kageyama, E. J. Appl. Polym. Sci.; 18: No. 11, 3379-3386(Nov 1974).

The types of free radicals formed in decrystallized cellulose prepared from cellulose I and II after γ-irradiation in nitrogen atmosphere at room temperature were studied by ESR spectroscopy. X-ray diffraction revealed that decrystallized cellulose I and II have the same microstructure. The ESR spectra obtained with the γ-irradiated decrystallized samples are simple. By contacting the irradiated sample with moisture in nitrogen atmosphere, the ESR spectrum changed to a narrow singlet, which gradually decreased in intensity until the spectrum completely disappeared. It was found that the types of free radicals generated in the decrystallized cellulose by γ-irradiation consist of the overlap of singlet and doublet. The singlet spectrum is mainly attributed to alkoxyl radical formed by the rupture of glycosidic linkage at the C 1 or C 4 position, and the doublet spectrum is ascribed to radical formed by hydrogen abstraction from the C 1 position in cellulose molecule. (auth)

10755 ELECTRON SPIN RESONANCE STUDIES OF γ-IRRADIATED CELLULOSE. II. Free Radicals in Accessible Regions to Water in Cellulose I and Cellulose II. Shimada, M. (Gunma Univ., Kiryu, Japan); Nakamura, Y.; Kusama, Y.; Matsuda, O.; Tamura, N.; Kageyama, E. J. Appl. Polym. Sci.; 18: No. 11, 3387-3396(Nov 1974).

The types of free radicals produced in the water-accessible regions of cellulose I and cellulose II fibers by γ-irradiation in nitrogen atmosphere at room temperature were studied by ESR spectroscopy. The ESR spectra of the irradiated cellulose I and II change by contacting the fibers with water, and after immersion in water the spectral shape depends on the orientation of the fiber axes to the magnetic field. These spectra are probably related to the free radicals generated in the highly ordered regions inaccessible to water in irradiated cellulosic fibers. The ESR spectrum of free radicals generated in decrystallized cellulose after irradiation consists of a singlet and a doublet. When the ESR spectra of free radicals formed in the highly ordered regions of cellulose I and II and the singlet and the doublet are combined in adequate ratio, the constructed spectra are similar to those of the radicals scavenged by water in the irradiated cellulose I and II fibers. From these facts, the spectra due to the free radicals in the water-accessible regions in irradiated cellulose I and II are considered to consist of the singlet and the doublet formed by free radicals in the typical amorphous regions and the spectra of other types of radicals generated in the semicrystalline regions. (auth)

10756 FRICTION AND WEAR OF VERY HIGH MOLECULAR WEIGHT POLYETHYLENE. Dumbleton, J. H.; Shen, C. (Univ. of Cincinnati). J. Appl. Polym. Sci.; 18: No. 11, 3493-3496(Nov 1974).

The friction and wear behavior of irradiated polymers has been little studied. McLaren and Tabor examined the frictional properties of poly(tetrafluoroethylene) which had been irradiated with γ-rays up to 50 Mrad. Except at the highest sliding speeds, it was found that irradiation increased the friction coefficient. Matsubara and Watanabe studied the friction and wear behavior of high-density polyethylene after γ-irradiation. The friction coefficient increased up to a certain level of irradiation and then decreased. The wear behavior was complicated. In the present work, the friction and wear of very high molecular weight polyethylene is reported. (auth)

10757 SCAVENGING OF ELECTRONS IN 3-METHYLPENTANE GLASS AT 77°K. Kroh, J. (Technical Univ., Lodz, Poland); Mayer, J.; Wojciechowska, E.; Grodkowski, J. J. Phys. Chem.; 78: No. 26, 2696-2697(19 Dec 1974).

3-MP glass containing biphenyl was γ irradiated and the concentrations of e_{tr}^- and biphenyl anions were measured as a function of time either by repetitive scanning or at 30-min intervals. The repetitive scanning resulted in an increase of Bph^-, whereas in the other case the anion concentration remained almost constant. This suggests that after irradiation Bph reacts mainly with photobleached electrons. Pulse experiments made at 77°K with a 13-MeV accelerator with precautions to minimize the possibility of optical bleaching verified that no growth of Bph^- occurred. The ratio of the rate constants of electron trapping to scavenging by Bph was calculated as 3.5×10^{-3}. (JSR)

10758 GRAFT COPOLYMERIZATION OF VINYL FLUORIDE WITH POLYETHYLENE. Yul'shibaev, A. A.; Sirlibaev, T. S.; Usmanov, Kh. U. Plast. Massy; No. 9, 26-27(1973). (In Russian).

For English translation see the journal Sov. Plast.

The graft copolymerization of vinyl fluoride from the vapor phase to powdered and film polyethylene under the influence of ^{60}Co γ rays is described. It was established that as a result of the grafting of vinyl fluoride to polyethylene its resistance to the effects of different organic solvents was improved. (tr-auth)

10759 RADIATION MODIFICATION OF ETHYLENE + VINYL ACETATE COPOLYMERS. Sirota, A. G.; Zajtseva, N. K.; Karkozova, G. F.; Ryabikov, E. P.; Bukhgalter, V. I.; Berlyant, S. M.; Gladigau, G. Plast. Massy; No. 2, 22-24(1974). (In Russian).

For English translation see the journal Sov. Plast.

The basic laws in the process of radiation modification of copolymers of ethylene and vinyl acetate were determined. It was established that vinyl acetate was crosslinked more effectively than polyethylene. With increase of the vinyl acetate concentration the crosslinking density was increased. Irradiation with absorbed doses from 0.5 to 1.5 Mrad led to an improvement of the strength characteristics of the material. In vinyl acetate polymers with very high fusion viscosity, partial crosslinking (concentration of the gel fraction no >2) guarantees the capacity of the material to be reprocessed by the extrusion method. (tr-auth)

10760 PRODUCTION OF COMBINED ION-EXCHANGE FIBERS BY THE LIQUID-PHASE COPOLYMERIZATION OF STYRENE WITH DIVINYLBENZENE ON POLYPROPYLENE FIBERS. Kapustina, I. B.; Kurilenko, A. I.; Kosenko, T. V.; Khorushko, R. P. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki; Belorusskij Gosudarstvennyj Univ., Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 29-32(1972). (In Russian).

The process for production of combined fibers by synthesis of copolymers of styrene and divinylbenzene on polypropylene fibers was studied. The copolymerization was initiated by benzoyl peroxide at 70°C and ^{60}Co γ rays with a dose rate of 100 rad/sec in the liquid phase in an oxidizing medium (methanol). With a weight ratio of the monomer and methanol mixture of 1:1, the dependence of the copolymerization rate on the styrene and divinylbenzene concentration was studied. The properties of the fibrous ion exchanger obtained by sulfurization of the combined fibers were determined. (tr-auth)

10761 INFLUENCE OF STABILIZATORS NATURE ON PLASTICIZER DESTRUCTION DURING γ-IRRADIATION. Krylova, S. V.; Kulikova, A. E.; Ovchinnikov, Yu. V. Plast. Massy; No. 12, 22-25(Dec 1973). (In Russian).

For English translation see the journal Sov. Plast.

The results of studies on metal stearates and phenol type stabilizers on destruction of dioctyl phthalate and dioctyl adipinate by gamma radiation are given. The effectiveness of plasticizers in protecting metal stearates from gamma radiation depended on the properties of the metal and that of the stabilizers, on the concentration and chemical structure of the phenol. The phenol derivative efficiency increased with increase in the phenol concentration. Metal stearates may be recommended for making colorless poly(vinyl chloride) materials but phenol type stabilizers cannot be. (tr-auth)

10762 INFLUENCE OF SOME ADDITIVES ON CHANGE OF PROPERTIES OF POLY(VINYL CHLORIDE) DURING IRRADIATION WITH GAMMA RAYS. Kabaivanov, V.; Khadzhidocheva, S. Plast. Massy; No. 9, 21-23(1973). (In Russian).

For English translation see the journal Sov. Plast.

The effect of sensitizers and other additives on the changes of some characteristics of poly(vinyl chloride) during γ irradiation was studied. It was established that during irradiation of solid compositions of polyvinyl chloride a very high concentration gel fraction was obtained in comparison with compositions with the same additions but irradiated in the powdered state. The relative tensile strength of the irradiated samples was altered to a greater degree than the tensile strength. Unsaturated polyester salts were characterized by very weak cross-linking effects in comparison with triallylcyanurates. With 40% triallylcyanurate added to polyvinyl chloride compositions for cable plasticizers its heat resistance during γ irradiation is increased 185. (tr-auth)

10763 PROPERTIES OF RADIATION-GRAFT POLYETHYLENE + POLYACENAPHTHYLENE COPOLYMERS. Zagorskaya, Z. G.; Tikhomirova, W. S.; Serenkov, V. I. Plast. Massy; No. 1, 9-11(1974). (In Russian).

For English translation see the journal Sov. Plast.

The physical-mechanical and thermomechanical characteristics of radiation-graft copolymers of polyethylene and polyacenaphthylene were examined in comparison with the characteristics of mechanical mixtures of these polymers. It was established that together with the reaction of the grafting of the monomer to polyethylene, crosslinking of the material as a result of the graft chain of polyacenaphthylene was observed. The density of crosslinking increased with increase of the concentration of the link section. Infrared spectroscopic and x-radiographic studies indicate that crosslinking of acenaphthylene to polyethylene occurred basically in the amorphous phase of polyethylene. (tr-auth)

10764 RADIATION-CURABLE COATING COMPOSITION. Maruyama, T. (to Kansai Paint Co., Ltd.). US Patent 3,847,768. 12 Nov 1974. Priority date 8 Jun 1970, Japan. 8p.

A coating composition characterized in that an ordinary coating composition that can be cured by applying ionizing radiation is mixed with at least one compound having the general formula: $M(NH_4)PO_4nH_2O$ wherein M is an element selected from the group consisting of magnesium, calcium, and strontium, and n is zero or a positive integer from 1 to 10. (Official Gazette)

10765 EFFECT OF CUPRIC ION ON THE RADIATION GRAFTING OF N-VINYL-2-PYRROLIDONE AND OTHER HYDROPHILIC MONOMERS ONTO SILICONE RUBBER. Ratner, B. D.; Hoffman, A. S. (Univ. of Washington, Seattle). J. Appl. Polym. Sci.; 18: No. 11, 3183-3204(Nov 1974).

Radiation grafting systems containing cupric ion, N-vinyl-2-pyrrolidone (N-VP) and other hydrophilic monomers were studied. Such systems, in certain Cu^{++} ion concentration ranges, were found capable of producing extremely high levels of graft on silicone rubber and other polymers. Gellation of the homopolymer surrounding the grafted film was inhibited by the presence of cupric salts. An increase in the graft water content and decrease in the wettability of the grafted film surface was noted as the Cu^{++} ion concentration in the grafting solution was increased. Based upon attenuated total reflectance infrared spectroscopic examination of the grafted materials, these effects could be explained by variations in the copolymer composition of the graft and increased penetration of the graft into the silicone rubber with increasing cupric ion concentration. The Cu^{++}/N-VP system allows many monomers which would ordinarily graft only with great difficulty to be readily grafted to polymeric surfaces. It also allows control over a number of graft parameters such as graft water content composition and penetration. Therefore, this system should be ideal for preparing a series of radiation grafted hydrogels to be used to evaluate important variables in the interactions of hydrophilic biomaterials and biological systems. (auth)

10766 PULSE RADIOLYTIC INVESTIGATIONS OF IODOPLATINATES: APPLICATION IN THE DETERMINATION OF PLATINUM IN METAPHOSPHATE GLASSES. Barkatt, A.; Kobayashi, Y. (Hebrew Univ. of Jerusalem). Anal. Chem.; 47: No. 1, (Jan 1975).

Experimental data are used to develop an analytical method for the determination of Pt traces in metaphosphate glass. (auth)

10767 HETEROCYCLIC COMPOUNDS. VI. Fragmentation Pattern of Certain Benzobisoxazoles Under Electron Impact. Osman, A. M.; Mohamed Metwally, S. A. (Assiut Univ., Egypt). Indian J. Chem.; 12: No. 7, 775-778(Jul 1974).

The mass spectra of some benzobisoxazoles, viz. 2,6-dimethylbenzo [1,2-d; 4,5-d']-(I),2,6-diphenylbenzo-[1,2-d; 4,5-d']-(II), and 2,6-diphenyl-4,8-dibenzylbenzo-[1,2-d; 4,5-d']-(III) bisoxazoles have been studied for the first time and the mode of fragmentation suggested. The molecular ions are degraded mainly by fission of one oxazole ring followed by the loss of an aziridinium or a phenylaziridinium group. By further rearrangements, other heterocyclic ring systems are formed. In addition, the mass spectrum of the intermediate Schiff base 2,5-di-(N-benzalimine)-1,4-benzoquinone (IV) has also been determined in order to compare the effect of electron impact on such intermediates which are the precursors of oxazoles. The behavior of IV under electron impact is typical of anils and p-benzoquinone. (auth)

10768 THE POLYMERIZATION OF ETHYLENE UNDER THE INFLUENCE OF GAMMA IRRADIATION. Part 2. Solution Phase Polymerization. Thomas, A. C. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Chemistry Div.). J. S. Afr. Chem. Inst.; 26: 10(1973).

8 refs.

The polymerization of ethylene in dilution systems promises several advantages over the bulk, gas-phase polymerization especially in terms of heat and mass transfer. In addition, radiation initiation, being externally and easily controlled, holds definite advantages over conventional chemical catalysts. Furthermore, liquids show greater efficiency than gases, even under high pressures, in absorbing radiation energy and, if coupled with suitable chain-transfer reactions, should produce greater reaction rates. A variety of solvents has been used to investigate the solution polymerization of ethylene in order to determine the effect of solubility and solvent on the yield. The influence of radiation intensity and ethylene pressure has also been examined and the polymer produced in the various systems has been cursorily examined. Infrared spectra of the polymer were used to provide evidence for the proposed initiation mechanism in the case of alcohols as solvents. The results show that except at low pressure, where the overall polymerization rate is low, little benefit in terms of yield is gained from effecting the polymerization in solution. (INIS)

10769 TECHNOLOGICAL PROCESS OF COATING SOLIDIFICATION BY ACCELERATED ELECTRONS. Review. Astakhova, R. S.; Malachevskaya, E. L.; Aveskina, O. Kh.; Shtan'ko, N. G. Lakokrasoch. Mater. Ikh Primen.; No. 6, 41-46(1973). (In Russian).

A review is presented of the literature and patents in which consideration is given to the industrial process of hardening of a coating by accelerated electrons. The effect of dose, dose rate, and multiple irradiation on the hardening process is indicated. Hardening of the coating by a fast electron flux can be carried out by two methods: by application of a previously irradiated material (irradiation of a material on stream), and by irradiation of a material on a backing. The first method has found hardly any application. In all operating units the method of irradiating a covering on a backing is used. A number of foreign installations are described. It is pointed out that in these installations it may be possible to induce not only free-radical polymerization of oligomere-monomeric systems, but also reactions of polycondensation, dimerization, etc. It is believed that with the use of similar installations it is possible to use the method of hardening by accelerated electrons for practically any kind of painting materials. (tr-INIS)

10770 DETECTION OF ALKOXY AND OTHER RADICALS IN THE GAMMA RADIOLYSIS OF ALCOHOLS BY AN ELECTRON SPIN RESONANCE AND SPIN TRAPPING METHOD. Sargent, F. P.; Gardy, E. M. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Can. J. Chem.; 52: No. 21, 3545-3650(1 Nov 1974).

The radicals produced during γ radiolysis of methanol, ethanol, 1-propanol, 2-propanol, and t-butanol have been trapped by reaction with 2-nitroso-2-methylpropane (t-nitrosobutane) to give nitroxides which are detected by ESR. All the alcohols gave alkoxy radicals and, with the exception of t-butanol, radicals derived by the loss of an H atom from the carbon atom adjacent to the OH group. Methyl radicals were detected in t-butanol. (auth)

10771 ENDOR AND ESR STUDIES OF RADIATION DAMAGE IN HISTIDINE HCl AND ACETYLHISTIDINE. Ngo, F. Q. H. Buffalo; State Univ. of New York (1974). 254p. University Microfilms Order No. 74-20,015.

Thesis (Ph. D.).

Magnetic resonance methods, ESR and ENDOR, were applied to the study of radiation damage in x-irradiated single crystals of L-histidine and N-acetyl-L-histidine. Free radicals formed at initial, intermediate and final stages of the radiation damage process have been identified and characterized. In irradiated histidine HCl the primary paramagnetic species consist of the carboxyl anion, hydrogen-abstraction cation, and decarboxylation cation. In acetylhistidine the primary radicals are the peptide anion and hydrogen-abstraction cation. The final radical is analogous to that found in histidine HCl. The hydrogen adduct spatial orientation in histidine HCl is very similar to that of the normal molecules as known from the crystal structure of histidine HCl. However, considerable reorientation takes place in acetylhistidine. The primary radicals can only be stabilized at low temperatures. On warming these species gradually disappear and concommitantly the intermediate or final radicals are generated. Mechanisms of radiation damage for these aromatic amino acid derivatives are proposed. Spin densities of the aromatic radicals are inferred from the anisotropic components of the α-proton hyperfine couplings. The results are compared with spin densities inferred from the isotropic components according to McConnell's relation. Comparison is also made with those calculated from HMO theory and McLachlan's SCF theory. Spin densities obtained from the anisotropic part, together with the isotropic couplings make it possible to estimate empirically some Q-values in McConnell's relation. For the hydrogen-addition radical, $|Q^H_{CH}|$ values from 83.3 to 86.0 MHz and $|Q^H_{NH}|$ values from 66.4 to 68.1 MHz are deduced. (Diss. Abstr. Int., B)

10772 SLOW METHYL GROUP TUNNELLING ROTATION FREQUENCY MEASUREMENTS BY ELECTRON NUCLEAR DOUBLE RESONANCE. Clough, A.; Hill, J. R.; Punkkinen, M. (Univ. of Nottingham, Eng.). J. Phys., C (London); 7: No. 20, 3779-3784(21 Oct 1974).

The frequencies of tunnelling rotation of both methyl groups in the free radical $(CH_3)_2\dot{C}COOH$, formed by γ-irradiation of crystals of α-aminoisobutyric acid, were studied at 4.2°K from small shifts of electron nuclear double resonance frequencies. The tunnelling frequencies (splitting of ground state divided by h) are >4 GHz and 1.4 ± 0.1 M Hz. The latter is of interest as the first case to be studied of a tunnelling frequency much less than the hyperfine interaction, so that the corresponding electron spin resonance hyperfine structure at low temperatures appears superficially to be characteristic of a methyl group whose rotational motion is completely frozen. (auth)

10773 EFFECTS OF METAL IONS ON THE FORMATION OF CHAIN BREAKS AND RADICALS IN γ-IRRADIATED COLLAGEN AND POLYADENYLIC ACID. Friedberg, F.; Kominami, S.; Nandedkar, A. K. N.; Riesz, P. (Howard Univ., Washington, DC). Radiat. Res.; 61: No. 1, 55-62(Jan 1975).

The effects of certain metal ions (Cu^{2+}, Fe^{2+}, Ni^{2+}, and Cd^{2+}) on the γ radiolysis of collagen and of polyadenylic acid in the solid state were investigated in the absence of air. A considerable degree of similarity was found between the effects of metal ions in reducing the radiation-induced decrease of the weight average molecular weight (as measured by the sedimentation equilibrium method) and the formation of stable carbon radicals at room temperature (determined by electron spin resonance measurements. (auth)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 10492 and 10701.

10774 RADIOISOTOPES AND RADIATION IN BIOMEDICINE. Gopal, N. G. S. (Bhabha Atomic Research Center, Bombay). pp 1-24 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A review is given of the use of radioisotopes and radiation in biomedicine. The topics considered are radiopharmaceuticals and their use, radiotherapy, radioisotopes for powering body implantation devices, radiation sterilization of medical products, and radiation sterilization of wastes. 57 references. (JSR)

10775 CHEMICAL STATE OF TECHNETIUM IN LABELLED COMPOUNDS OF MEDICINAL IMPORTANCE. Narasimban, D. V. S.; Mani, R. S. (Bhabha Atomic Research Centre, Bombay). pp 47-54 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The radiochemical purity of ^{99m}Tc-labelled human serum albumin and sulfur colloid was studied by gel filtration, column chromatography, and biological distribution. The results indicate that the albumin can contain radiochemical impurities such as hydrolyzed adsorbed Tc species. The sulfur colloid probably contains hydrolyzed Tc species adsorbed on the carrier or sulfur particles. (JSR)

10776 RADIO TRACER APPLICATION IN THE STUDY OF COMBINED ION EXCHANGE–SOLVENT EXTRACTION (CIESE) OF SOME TRANSITION ELEMENTS. Shanker, R.; Venkateswarlu, K. S. (Bhabha Atomic Research Centre, Bombay). pp 107-110 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The combined ion exchange–solvent extraction behavior of Cr(III), Cr(VI), Mn(II), Fe(III), Co(II), Cu(II), and Ru(III) was studied using radioactive tracers. The organic solvent used was tetrahydrofuran and HCl was added to the aqueous component of the solution. The cation exchanger was Amberlite SA-2. The R_f values (defined as the ratio of the distance travelled on the exchanger-impregnated paper by the center of the developed zone to the total distance traveled by the solvent) were measured and plotted against HCl concentration. In all cases the R_f values increased with increasing HCl concentration until a saturation point was reached. It was concluded that the protonated species of THF in the mobile phase compete with the stationary anionic exchange sites on the paper for the anionic chloro species of the transition elements. (JSR)

Hot-Atom Chemistry

Refer also to abstracts 10512, 10740, and 12823.

10777 (ORO-3602-15) REACTIONS OF CHARGED AND NEUTRAL RECOIL PARTICLES FOLLOWING NUCLEAR TRANSFORMATIONS. Progress Report No. 8. Ache, H. J. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemistry). Sep 1974. 24p. Dep. NTIS $4.25.

The following projects are under current study: nuclear decay induced reactions of halogen species with organic compounds using ^{80}Br, decay-induced labelling of compounds of biochemical interest using ^{80m}Br or ^{82m}Br, hot atom reactions of C, and the chemistry of positronium. The publications published during the period from Oct. 1, 1973, to August 31, 1974 are tabulated. (JSR)

10778 RING OPENING IN 1,1-DIMETHYLCYCLOPROPANE BY RECOIL TRITIUM ATOMS. Su, Y. Y.; Tang, Y. N. (Texas A and M Univ., College Station). J. Phys. Chem.; 78: No. 25, 2531-2535(5 Dec 1974).

Recoil tritium reactions with 1,1-dimethylcyclopropane in O_2-scavenged, nonscavenged, and H_2S-scavenged systems have been studied. Products from ring-opening processes are distinguished from those of primary substitution and secondary isomerization. The relative efficiency for the three modes of ring opening in this molecule has been found to be approximately 10 : 1 : 1 in favor of the mode involving attachment of the tritium atom to the second carbon and cleavage of the C_1-C_2 bond. (auth)

10779 CHEMICAL EFFECTS OF ^{51}Cr NEUTRON CAPTURE RECOILS IN $K_2CrO_4-K_2SO_4$ MIXED CRYSTALS. Sherif, M. K. (Assiut Univ., Egypt); Issa, I. M.; Diefallah, E. M.; Mousa, M. A.; Aly, H. F.; Rassoul, A. A. A. Indian J. Chem.; 12: No. 7, 712-713 (Jul 1974).

The chemical effects of radiative neutron capture and associated radiation damage were investigated for ^{51}Cr produced in isomorphous mixed crystals of the type $K_2CrO_4-K_2SO_4$. Chromate parent retention increases with dilution and depends on the mole fraction of the parent in an exponential manner. An electron acceptor-donor mechanism involving electron-hole traps and electron recombination centers has been proposed to explain the influence of isomorphous dilution on the probability of parent reformation. (auth)

Properties of Radioactive Materials

Refer also to abstracts 10678, 10690, 11761, and 11859.

10780 (CONF-711232-2) HYDROLYSIS OF THORIUM(IV) IN LITHIUM, POTASSIUM, AND MAGNESIUM NITRATE MEDIA. Milic, N. B. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia). Lab. za Hemijsku Dinamiku). [nd]. 20p. Dep. NTIS (US Sales Only) $4.00.

The hydrolysis of the thorium(IV) ion in the lithium, potassium,

and magnesium nitrate media was studied by potentiometric and coulometric method. Using LETAGROP computer program several hydrolytic complexes of thorium type $Th_q(OH)_p^{[4q-p]+}$ are found. From those only complex $Th_2(OH)_2^{6+}$, as main species, was found in all three nitrate media. Different values of the hydroxyl number of thorium in studied media, as well as different composition of some complexes, indicate influence of the cation of nitrate media on the hydrolysis of thorium ion. (auth)

10781 (CONF-741002-P2, pp 502-509) MOESSBAUER EFFECT STUDIES OF EUROPIUM-151 COMPLEXES. Kumar, S.; Rao, G. N.; Medhi, O. K.; Agarwala, U. (Indian Inst. of Tech., Kanpur). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The Moessbauer studies of some of the Eu^{+3} complexes of the ligands containing oxygen or nitrogen as donor atoms are reported. The resonance effects in these complexes were studied in order to investigate the extent of polymerism in the complexes. (auth)

10782 (ICP-1056, pp 26-27) IN-CELL ANALYSIS OF ELECTROLYTIC DISSOLVER CONTAMINATION. Wilcox, C. M. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

10783 (NAS-NS-3060) RADIOCHEMISTRY OF NEPTUNIUM. Burney, G. A.; Harbour, R. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Dec 1974. Contract AT(07-2)-1. 236p. Dep. NTIS $3.00.

For National Academy of Sciences–National Research Council, Washington, D. C. Subcommittee on Radiochemistry.

Topics covered include: general review of the inorganic and analytical chemistry of neptunium; general review of the radiochemistry of neptunium; discovery and occurrence of neptunium; isotopes and nuclear properties of neptunium; chemistry of neptunium; preparation of neptunium samples for analysis; separation methods; analytical methods; radioactive safety considerations; and a collection of 25 procedures for separation and determination of neptunium. (MCG)

10784 KINETICS OF THE HYDROLYSIS OF URANYL FLUORIDE WITH WATER VAPOR. Seleznev, V. P.; Tsvetkov, A. A.; Sudarikov, B. N.; Gromov, B. V.; Ivankova, T. F. (Moscow Chemical-Technological Inst.). Kinet. Catal. (USSR) (Engl. Transl.); 15: No. 2, 299-303(1974).

Translated from Kinet. Katal.; 15: No. 2, 344-348(1974).

The kinetic characteristics of the interaction process between uranyl fluoride and water vapor in the temperature range 420 to 580°C and for partial pressures of the water vapor of 0.0967 to 0.691 atm were obtained. The dependence of the degree of hydrolysis of uranyl fluoride on time is depicted by the equation of a contracted sphere; the activation energy of the reaction amounts to 22.9 to 24.1 kcal/mole; the order of the reaction with respect to the water vapor is 0.47 to 0.55. The hydrolysis of uranyl fluoride is accompanied by the dissociation of uranium trioxide, therefore, the solid hydrolysis products have a composition varying from UO_3 to U_3O_8. The dissociation of the uranium oxides does not affect the hydrolytic decomposition rate of uranyl fluoride. (auth)

10785 SAFE STORAGE IN LYOPHILISED STATE OF ^{131}I-LABELLED ALBUMIN PARTICLES. Kutas, V.; Kocsar, L.; Holland, J.; Meretey, K. (Orszagos Frederic Joliot-Curie Sugarbiologiai Sugaregeszsegugyi Kutato Intezet, Budapest). Int. J. Appl. Radiat. Isotop.; 25: No. 9, 415-419(Sep 1974).

Inappropriate temperature during storage and shipping, respectively, affects the quality of labelled protein preparations disadvantageously. After lyophilization the human serum albumin macroaggregate, labelled with iodine isotopes, retains its original properties provided it is lyophilized within 24 hr after its production. It can be resuspended completely; the size of the particles and the content of free iodine stay unchanged. Storage at 20°C for 14 days does not affect the quality of the lyophilized product. (auth)

10786 NATURE OF THE DIOXOBIS(TROPOLANATO) URANIUM(VI) SYSTEM AND ITS COMPLEXES WITH NEUTRAL LIGANDS. Crystal and Molecular Structure of Dioxo(Pyridine) Bis(Tropolonato) Uranium(VI). Degetto, S. (Consiglio Nazionale Delle Ricerche, Padua); Marangoni, G.; Bombieri, G.; Forsellini, E.; Baracco, L.; Gaziani, R. J. Chem. Soc., Dalton Trans.; No. 18, 1933-1939(1974).

Uranyl tropolonato complexes, of general formula UO_2t_2 and $UO_2t_2 \times H_2O$ (Ht = tropolone) have been prepared. Physical properties are discussed and structures suggested. Their reactivities were tested by preparing adducts with a series of neutral ligands L (L = methanol, water, dimethyl sulfoxide, pyridine N-oxide, triphenylphosphine oxide, cyclohexanone, pyridine, and aniline). The crystal structure of the pyridine (py) adduct $UO_2t_2(py)$ has been determined by X-ray diffraction methods by the heavy-atom method from counter data on 3252 reflections, and refined to R 0.058 by a full-matrix least-squares procedure. The monoclinic unit cell, space group I2/a (standard cell C2/c), has dimensions a = 17.88(1), b = 12.69(1), c = 16.79(1) Å, β = 98.32(10°) for Z = 8. The molecule has approximately C_{2v} symmetry. Two tropolonato groups and the pyridine ligand are displaced slightly from the plane perpendicular to the linear uranyl group. The U-O(uranyl) distances are 1.78 and 1.79 Å; the four U-O(eq) distances are almost equal (2.37 to 2.38 Å) and U-N(py) is 2.61 Å. (auth)

10787 COORDINATION OF URANYL BIS(THENOYL TRIFLUOROACETONATE) WITH SOME HETEROCYCLIC N-OXIDES. Manchanda, V. K.; Shukla, J. P.; Subramanian, M. S. (Bhabha Atomic Research Centre, Bombay). J. Inorg. Nucl. Chem.; 36: No. 11, 2595-2598(Nov 1974).

Organic phase equilibrium constants of the synergistic systems, UO_2^{2+}/thenoyl trifluoroacetone (TTA)/heterocyclic N-oxide/chloroform were determined by the solvent extraction procedure. Free base concentrations were determined spectrophotometrically in a single step. The results indicate that the equilibrium constants of the systems with the various N-oxides follow the trend 2 : 6 dimethyl pyridine N-oxide (2 : 6 DMPO) < pyridine N-oxide (PyO) < 2 methyl pyridine N-oxide (2 MPO) < 3 methyl pyridine N-oxide (3 MPO) < 4 methyl pyridine N-oxide (4 MPO). The deviation of 2 : 6 dimethyl and 2 methyl pyridine N-oxides from the pK_a order of the series has been attributed to the occurrence of steric effects with these ligands. No evidence is observed for back donation of electrons from the uranyl group to the π^* antibonding orbital of the N-oxide ligand. (auth)

10788 SPECTRAL STUDIES OF f–d AND f–f TRANSITIONS OF Pa(IV) IN MOLTEN LiF–BeF_2–ThF_4. Young, J. P.; Bamberger, C. E.; Ross, R. G. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 11, 2630-2632(Nov 1974).

Molten salts in general provide an excellent solvent system for spectral studies of radioactive solute species, such as the actinides. Compared to aqueous or organic systems, molten salt solvents are more stable with respect to radiation damage and possess a wider spectral transparency range. In the case of the molten solvent LiF-BeF_2-ThF_4(72-16-12 mole percent) the transparency range extends from less than 200 nm to well past 2.5 μ, a range such that both f-d and f-f transitions of Pa(IV) could possibly be observed. For these reasons and because protactinium is a nuclear product of interest in breeder reactor fuels, the spectral study of Pa(IV) in the above-mentioned solvent salt was undertaken. Results are presented and discussed. (auth)

10789 SPECTROPHOTOMETRIC STUDIES OF DIOXOURANIUM(V) IN AQUEOUS MEDIA. I. The Perchlorate Medium. Bell, J. T.; Friedman, H. A.; Billings, M. R. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 11, 2563-2567(Nov 1974).

The spectrum of UO_2^+ in aqueous perchlorate medium is described as two absorption bands at 9400 and 7380Å, with higher energy absorption beginning at ~6500Å and increasing at shorter wave-lengths to at least 5000Å. Thermodynamic values of K, $\Delta F°$, $\Delta H°$ and $\Delta S°$ for the disproportionation of UO_2^+ were determined to be 7×10^4, –6.6 kcal, –18.6 kcal and –40 e.u., respectively. The value of $S°$ for UO_2^+ was determined to be –11 e.u. (auth)

10790 ISOLATION AND STRUCTURAL CHARACTERIZATION OF A μ-DI(η^5:η^1-CYCLOPENTADIENYL)DITHORIUM(IV) COMPLEX. Baker, E. C. (Univ. of California, Berkeley); Raymond, K. N.; Marks, T. J.; Wachter, W. A. J. Amer. Chem. Soc.; 96: No. 24, 7586-7588(27 Nov 1974).

Toluene solutions of $(C_5H_5)_3Th(n\text{-}Bu)$ at 170° slowly deposit almost quantitatively colorless crystals which analyze as $[(C_5H_5)_2ThC_5H_4]_2$. Crystal lattice parameters were determined by x-ray diffraction analysis. The molecular structure is that of a dimeric complex. Each Th atom is π bonded to three cyclopentadienyl α bonded to one of the cyclopentadienyl rings of the other Th atom. The coordination system about the Th is approximately the same as in other actinide $Ac(C_5H_5)_3X$ structures. (JSR)

10791 MAGNETIC PROPERTIES OF URANIUM CHALCOGENIDES. I. U_3Y_5-TYPE COMPOUNDS. Suski, W.; Reizer-Netter, H. (Inst. for Low Temperature and Structure Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 8, 701-707(Oct 1974).

Magnetic measurements on orthorhombic U_2S_3 and U_2Se_3, and tetragonal U_2S_3 were performed in the temperature range 4.2–1000°K and in magnetic fields up to 80 KOe. The temperature

dependence of the reciprocal magnetic susceptibility was found to be curvilinear for all the investigated compounds. Magnetic properties in the paramagnetic region were discussed in terms of the point charge model for the $U_I^{+}Y_I$ and $U^{4+}U_I^{+}Y_I$ cases. The anomalies observed at low temperatures were supposed to be connected with the magnetic ordering with a ferromagnetic contribution. (auth)

10792 PEROVSKITE PHASES IN THE SYSTEMS $AO-SE_2O_3-UO_{2+x}$ WITH A = ALKALINE EARTH METAL AND SE = RARE EARTHS, La, AND Y. VII. The Systems $Sr_2(SE_{1-3x}Sr_{2x}U^{V}_{x})U^{V}O_6$ and $Sr_{2.67-y}Ca_yU^{V}_{1.33}O_6$. Kemmler-Sack, S.; Seemann, I. (Tuebingen Univ., Ger.). Z. Anorg. Allg. Chem.; 409: No. 1, 23-34 (Oct 1974). (In German).

In the $Sr_2(SE_{1-2x}Sr_{2x}U_x)UO_6$ system the phase boundary does not reach the composition $Sr_{2.67}U_{1.33}O_6$ (x = 0.33). Perovskite phases with lower SrO contents are built up instead. In the $Sr_{2.67-y}Ca_yU_{1.33}O_6$ series an incorporation of Ca^{2+} is possible for y = 0.67 and 1.33. For greater y values compounds with lower alkaline earth oxide contents are formed. They contain cationic and anionic vacancies. (auth)

10793 CRYOMETRIC STUDIES OF THE SYSTEM $CdCl_2-UCl_4$. Gawel, W.; Terpilowski, J. (Inst. of Chemistry and Chemical Tech., Wroclaw). Rocz. Chem.; 48: No. 10, 1683-1686(1974).

The phase equilibria in the system $CdCl_2-UCl_4$ was examined. On the basis of liquidus curve, a thermodynamic description of the liquid phase in this system is given. (auth)

10794 RAMAN STUDIES OF CHLOROURANATES(V) AND CHLORONIOBATES. Stumpp, E.; Plitz, G. (Technische Univ., Ger.). Z. Anorg. Allg. Chem.; 409: No. 1, 53-59(Oct 1974). (In German).

Raman spectra of the compounds $AM^{V}Cl_6$, where A = Li, Na, K, Rb, Cs, Tl and M = U or Nb have been obtained and are discussed from the point of O_h symmetry for the MCl_6^{-} ions. An assignment of the observed bands is presented. The Raman spectrum of solid $UCl_5 \cdot PCl_5$ is compatible with the structure $PCl_4^{+}UCl_6^{-}$. (auth)

10795 SERNISTYE SOEDINENIYA URANA. (Sulfur Compounds of Uranium). Spitsyn, V. I. (ed.). Moscow; Izdatel'stvo Nauka (1974). 140p.

The physical-chemical and thermodynamic properties, structure, character of the chemical bonds, and possibilities for the practical use of sulfur compounds of uranium are examined. An extensive bibliography of Soviet and foreign works is included. (tr-auth)

10796 PREPARATION AND PURIFICATION OF LABELLED HORMONES FOR RADIOIMMUNOASSAY. Prabhakaran, R. J. V.; Desai, C. N.; Mani, R. S. (Bhabha Atomic Research Centre, Bombay). pp 35-46 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The human chorionic gonadotropin HCG-^{125}I, human luteinizing hormone HLH-^{131}I, and follicle stimulating hormone FSH-^{125}I were prepared by a modification of the chloramine-T method and purified by gel filtration, microcellulose column chromatography, paper electrophoresis, and starch block electrophoresis. The microcellulose chromatographic technique gave good results and is simple and inexpensive. The labelled compounds must be stored at low temperatures around -20°C. (JSR)

10797 ASPECTS ON THE SYNTHESIS OF HIGH-SPECIFIC-ACTIVITY TRITIUM-LABELLED THYMIDINE. Viswanathan, K. V.; Garana, A. U.; Lakshmy, R.; Sarkar, B. R. (Bhabha Atomic Research Centre, Bombay). pp 85-88 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

T-labelled thymidine was prepared by reduction of 5-hydroxymethyl-deoxyuridine in the presence of 5% Rh on alumina as catalyst and using dioxane containing 25% acetic acid as the solvent. A product of high specific activity labelled exclusively in the base portion of the nucleoside was obtained. The specific activity was 27.5 Ci/mm, close to the theoretically expected value of 28. (JSR)

10798 PREPARATION OF RADIOACTIVE ALBUMIN MICROSPHERE. Choudhary, S. Y.; Mani, R. S.; Ramjilal. (Bhabha Atomic Research Centre, Bombay). pp 89-97 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The effects of pertechnetate reducer (ascorbic acid), pH, and incubation temperature on obtaining stable binding of ^{99m}Tc to iron-impregnated albumin microspheres were studied. The optimum amount of ascorbic acid and $FeCl_2 \cdot 6H_2O$ were determined. The binding of ^{99m}Tc takes place in two stages; in the first the optimum pH is 1.5 to 2 and in the second 5 to 6. The optimum incubation temperature was found to be about 100°C. The technique for ^{113m}In labelling of iron-impregnated microspheres was outlined. Labelling with ^{59}Fe or ^{125}I was also successfully done. Stability and biological studies were made. (JSR)

10799 IMPROVED PROCEDURE FOR THE PURIFICATION OF SOME LABELLED MERCURIAL DERIVATIVES OF MEDICAL IMPORTANCE. Singh, L. N.; Mani, R. S. (Bhabha Atomic Research Center, Bombay). pp 99-105 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Radiomercury-labelled (^{203}Hg) 3-chloromercury-2-methoxypropylurea, 3-acetoxymercury-2-methoxypropylurea, acetomercuryhydroxypropane, and bromomercuryhydroxypropane of high specific activity can be purified from unbound ionic mercury impurities by direct precipitation of mercuric mercury as the hydrated oxide. In aqueous solution of high specific activity, the acetomercury and the chloro- and bromomercury derivatives are practically indistinguishable by paper chromatographic analysis. This closely similar behavior may probably be due to the fact that the acetoxychloro and bromo derivatives in aqueous solution undergo partial conversion to the hydroxy derivative. (auth)

10800 RADIOCHEMICAL STUDIES OF THE ACTINIDES. Ramaniah, M. V. (Bhabha Atomic Research Centre, Bombay). pp 133-182 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A review is presented of the work being done at the Bhabha Atomic Research Centre on the radiochemistry of the actinides. As the chemistry of U and Th is widely studied, the present work concentrates on the fission and radiochemistry of Pu, Np, Am, and Cm. The production and physical properties of the actinides is first briefly summarized, and the facilities available at Trombay are indicated. The fission studies and chemical studies are described in some detail. 101 references. (JSR)

10801 APPLICATION OF INORGANIC ION EXCHANGERS FOR POLISHING URANIUM PRODUCT OF REPROCESSING PLANTS. Murthy, T. S.; Ananthakrishnan, M.; Mayankutty, P. C.; Mani, V. V. S.; Nadkarni, M. N. (Bhabha Atomic Research Centre, Bombay). pp 209-215 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The capacity of polyantimonic acid to remove Pu and fission products from the tail-end U product of a reprocessing plant was studied for HNO_3 solutions of various molarities. The results show that the distribution ratio of Pu decreased with increasing acid. The effect of U/Pu ratios on the distribution pattern of Pu was studied and the results showed that large amounts of U inhibited the uptake of Pu. The U/Pu ratio played a more important role in the Pu uptake than the Pu concentration. Break-through studies for Pu showed that break-through capacities are greatly influenced by the acid concentration both in the presence and absence of U. The presence of Na inhibited the uptake of Pu on polyantimonic acid. In elution studies it was shown that 0.01M ascorbic acid + 2M HNO_3 eluted more than 98% of the Pu held on the ion exchange column. (JSR)

10802 PROTONATION CONSTANTS OF THE LANTHANIDE (III)-ETHYLENEDIAMINETETRAACETATE COMPLEXES. Bruecher, E.; Kukri, C. E.; Zekany, L. (Kossuth Lajos Tudomonyegystem, Debrecen, Hungary). J. Inorg. Nucl. Chem.; 36: No. 11, 2620-2623(Nov 1974).

A new study is reported of the equilibrium $LnEDTA^{-} + H^{+} \rightleftharpoons HLnEDTA$, which is important in the ion exchange separation of macro-amounts of lanthanides and also in kinetic studies of the exchange reactions of the LnEDTA complexes. The protonation constants were determined by a pH-potentiometric titration method at 25°C. The results are discussed. (UK)

10803 RELATION TO THE LUMINESCENT PROPERTIES OF RADIOACTIVE PHOSPHORS $CaSO_4 \cdot Mn$ TO STRUCTURAL DEFECTS. Ivanov, L. N.; Karaseva, L. G.; Saunin, E. I.; Gromov, V. V.; Karlin, V. V. Zh. Prikl. Spektrosk.; 21: No. 4, 739-741 (Oct 1974). (In Russian).

By the methods of radioluminescence and electron paramagnetic resonance with the simultaneous study of the kinetics of the growth of the radioluminescence of Mn^{2+} and accumulation of paramagnetic centers (ion radicals SO_3^- and SO_4^-) in the radioactive phosphor $^{45}CaSO_4 \cdot Mn$ it was shown that these ion radicals are the centers of sensitization with respect to the Mn^{2+} ions. This conclusion was confirmed by tests with annealed $Ca^{35}SO_4 \cdot Mn$ phosphors. The participation of the ion radicals in processes leading to luminescence of the $CaSO_4 \cdot Mn$ phosphors is caused also by coincidence of the thermal intensity of the traps, responsible for the peak at 105 to 115°C, with the activation energy of the ion-radical recombination reaction. (tr-auth)

10804 ABSORPTION SPECTRA OF $NpCl_3$ AND $NpBr_3$. Carnall, W.T.; Crosswhite, H.M.; Pappalardo, R.G.; Cohen, D.; Fried, S.; Lucas, P.; Wagner, F. Jr. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). J. Chem. Phys. 61: No. 12, 4993-5008 (15 Dec 1974).

Low temperature absorption spectra are reported for $NpCl_3$ and $NpBr_3$ in the range 3300–40 000 cm^{-1}. Term assignments are made to a number of excited levels not previously identified, and the data are interpreted in terms of a refined free–ion model. Some of the parameters associated with this model are found to have similar values for both 3+ actinide and lanthanide chlorides. The values determined for other of the parameters are in good agreement with those calculated independently using Hartree–Fock methods. The similar crystal–field quantum number ordering of levels in the ground states of actinide trichlorides and analogous lanthanides doped into $LaCl_3$ is noted and discussed. (auth)

10805 IONIZATION POTENTIAL OF THORIUM. Hildenbrand, D.L.; Murad, E. (Air Force Cambridge Research Labs, Laurence G. Hanscom Field, Bedford, Massachusetts 01730). J. Chem. Phys. 61: No. 12, 5466-5467 (15 Dec 1974).

The ionization potential of thorium is measured by electron impact using molybdenum as a reference, and compared to previous results. The result is obtained in I.P.(Th) = 6.2 ± 0.2 eV. An attempt to deduce I.P.(Th) by dissociative ionization of ThO was not successful. (AIP)

10806 PHOTO-IMAGING UTILIZING URANYL COMPOUNDS. Levinos, S. (to Keuffel and Esser Co.). US Patent 3,852,070. 3 Dec 1974. Filed Date 24 Aug 1972. 4p.

Imagewise light exposure of a layer of a composition comprising a uranyl compound and an hydroxyl-containing compound results in photolytic reduction of uranyl ions which, upon subsequent contact with a developer fluid containing ferricyanide ions, form an imagewise deposition of a distinct uranyl ferrocyanide color body. Application of a toning fluid containing ferric ions may subsequently be employed to achieve neutral image tones. (Official Gazette)

10807 PRODUCTION OF URANIUM DIOXIDE IN A ROTARY KILN. Littlechild, J. E.; Gillies, G. M. (to United Kingdom Atomic Energy Authority). US Patent 3,845,193. 29 Oct 1974. Priority Date 15 Oct 1969, United Kingdom of Great Britain and Northern Ireland. 4 p.

Uranium hexafluoride is reacted with dry steam in one region of a process vessel and the uranyl fluoride produced is deposited directly in a second region of the process vessel for reaction at a higher temperature with steam hydrogen or a steam/hydrogen mixture to produce a required uranium oxide. In a particular process the uranium hexafluoride and dry steam are passed together through a jet into an inlet chamber at the upper end of the barrel of a rotary kiln. The gases issuing from the jet react to form a plume of uranyl fluoride powder which is deposited directly in the upper end of the kiln barrel. The uranyl fluoride powder passes down the kiln barrel in counter current flow to a steam hydrogen mixture which converts the uranyl fluoride to uranium dioxide. (Official Gazette)

10808 FREE ENERGY OF FORMATION OF URANYL IONS AT HIGH TEMPERATURES. Rafal'skii, R. P. Sov. At. Energy (Engl. Transl.); 34: No. 2, 146-148(Feb 1973).

Translated from At. Energ. (USSR); 34: No. 2, 115-116(Feb 1973).

Corrected values of the previously reported equilibrium constant of the reaction $2UO_2^{2+}$ (aq) + $2H_2O$ (l) ⇌ $2UO_2$ (s) + $4H^+$ (aq) + O_2 (g) were calculated. Equilibrium activities were calculated for the main components in the solution (H^+, HSO_4^-, H_2S, H_2SO_3) and the concentrations in the gaseous phase (H_2S, SO_2). In addition, values of the free energy of uranyl-ion formation in aqueous solutions at high temperatures were calculated on the basis of this constant. (JGB)

10809 QUALITY CONTROL OF RADIOACTIVE PREPARATIONS. Jasz, A. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 470-472(1974). (In Hungarian).

Information on the routine control of the preparations is presented. Practical suggestions for use of the methods described are included. (auth)

10810 INVESTIGATION OF URANYL FLUORIDE AQUEOUS SOLUTIONS BY THE ^{19}F NMR METHOD. Buslaev, Yu. A.; Peshkov, V. V.; Davidovich, R. L. (AN SSSR, Moscow. Inst. Obshchej i Neorganicheskoj Khimii; AN SSSR, Vladivostok. Inst. Khimii). Dokl. Akad. Nauk SSSR; 214: No. 5, 1101-1104(11 Feb 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

Aqueous solutions of uranyl fluoride were studied by the NMR of ^{19}F. The behavior of uranyl, aluminum, and beryllium fluorides in solution and the stability of their fluoride forms were compared. The processes of redistribution of the fluorine were studied. The NMR spectrum of ^{19}F of UO_2F_2 solutions consists of one broad signal. Its location and form depended on the temperature and concentration of the solution. The dependence of the chemical shift of UO_2F_2 from the molar ratio UO_2^{2+}/UO_2F_2 in solution on the temperature was determined. The redistribution of the fluoride ions in aqueous solutions of $Be(NO_3)_2-UO_2F_2$ and $Al(NO_3)_3-UO_2F_2$ was studied. (tr-auth)

10811 X-RAY INVESTIGATION OF DIPHTHALOCYANINE COMPLEXES OF THORIUM AND URANIUM. Kirin, I. S.; Kolyadin, A. B.; Lychev, A. A. (Leningrad Inst. of Nuclear Physics). J. Struct. Chem. (USSR) (Engl. Transl.); 15: No. 3, 415-418(1974).

Translated from Zh. Strukt. Khim.; 15: No. 3, 486-490(1974).

An x-ray diffraction investigation of the crystals of thorium and uranium diphthalocyanine complexes was undertaken, and it was shown that they are isostructural with the following characteristics: space group B2/b, Z = 4; UPc_2: α = 18.73, b = 15.60, c = 18.70 Å, γ = 113.7°; $ThPc_2$: α = 18.74, b = 15.79, c = 18.73 Å, γ = 113.3°. The structures were interpreted by the heavy-atom method and refined by the method of least squares in isotopic approximation to R = 0.140 ($ThPc_2$) and 0.137 (UPc_2). The molecules are of the sandwich type, formed by two distorted phthalocyanine ligands rotated to each other by 38°. The metal atom lies at the center of a distorted square antiprism formed by the eight nitrogen atoms. (auth)

10812 AROMATIC COMPOUNDS OF ASTATINE. Vasaros, L.; Berei, K.; Norsze'ev, Yu. V.; Halkin, V. A. (Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete es, Budapest). Magy. Kem. Foly.; No. 10-11, 487-490(1974). (In Hungarian).

Astatobenzene, o-, m- and p-C_6H_4XAt (X = F, Cl) were produced by heterogeneous exchange reaction of bromine and/or iodine for At in mono- and disubstituted aromatic halogen derivatives. The boiling points of the aromatic astatocompounds were determined on the basis of the linear relationship between the gaschromatographic retention indexes and the boiling points of the analogous aromatic halogen derivatives. The C–At bond energies in some aliphatic and aromatic compounds were calculated. (auth)

10813 EVAPORATION AND PHASE COMPOSITION OF NEODYMIUM CARBIDES. Antonova, N. L.; Kutsev, V. S. Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 314-317(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 537-541(Mar 1974).

The phases in the neodymium–carbon system were investigated by x-ray diffraction and mass spectroscopy. Carbides with the compositions $NdC_{0.5}$, $NdC_{1.1-1.25}$ (Pu_2C_3 type), $NdC_{1.59-1.86}$, and NdC_2 (tetragonal system) were found. Evaporation from the effusion cell in the range 1500 to 2000°K results in the elimination of neodymium atoms from the crystal lattice of the carbides in the form of a vapor and the enrichment of the solid phase in carbon up to the limiting composition NdC_2. The partial enthalpies of evaporation have been determined as 63–76 ± 3 kcal/g-atom of neodymium for $NdC_{1.1}$ (Pu_2C_3 type phase) and 107 ± 2.2 kcal g-atom^{-1} for the NdC_2 phase. (auth)

10814 IMPROVED RADIO-SYNTHESIS AND INVESTIGATION OF PENTYLENETETRAZOL-10-^{14}C. Dirksen, J. W. Lafayette, IN; Purdue Univ. (1972). 156p. University Microfilms Order No. 74-26,670.

Thesis (Ph. D.).

A survey of the literature on the methods of synthesis of pentylenetetrazol and radiolabeled pentylenetetrazol revealed that higher yields of final product had been obtained for the synthesis of the unlabeled compound. The differences in yield were of such a magnitude that it was hypothesized that an improved synthetic procedure for pentylenetetrazol-10-^{14}C was possible. In the improved synthesis, pentylenetetrazol-10-^{14}C was synthesized by reacting cyclohexanone-1-^{14}C with hydrazoic acid. The hydrazoic acid was prepared by slowly adding concentrated sulfuric acid to an aqueous sodium azide paste in a benzene-n-heptane (85:15) solvent. Cyclohexanone-1-^{14}C was added drop-wise to the dried hydrazoic acid solution obtained above. One gram of anhydrous ferric chloride catalyst was added to the reactants for each gram of ketone. The reactants were cooled to 0° in a dry ice-2-

ethoxyethanol cold bath. The 0° temperature was maintained by periodically adding dry ice to the bath until after addition of the final portion of cyclohexanone. After 4 hours the reaction was terminated, the reactants made alkaline with 30% sodium hydroxide and centrifuged at 3000 rpm for 6 minutes. The organic layer was separated from the aqueous layer. After saturation of the aqueous layer with ammonium sulfate the product was extracted with 6 portions of benzene. The benzene was removed with vacuum and the resultant impure pentylenetetrazol dried. The average of two syntheses revealed that a 75% yield was obtained. Purification was accomplished by crystallization with an ethanolic-n-heptane solvent system. An average yield of 60% was obtained after purification of the two raw products. Radiochemical purity was determined for the synthesized pentylenetetrazol-10-^{14}C by thin-layer chromatography and autoradiography. The per cent purity was found to be greater than 99.5% as determined by liquid scintillation counting. A melting point of 57.7 to 58.9° was obtained to verify chemical purity. A 60% yield of pure pentylenetetrazol-10-^{14}C was realized in this study. The chemical yield of the radiolabeled synthesis was increased by approximately 20 per cent over the previously reported labeled synthesis. The product had a radiochemical purity greater than 99.5% as determined by autoradiography and liquid scintillation counting. (Diss. Abstr. Int., B)

10815 COMBUSTION APPARATUS AND METHOD FOR MATERIALS CONTAINING A RADIOACTIVE ISOTOPE TRACER. Kaartinen, N. H. (to Packard Instrument Co., Inc.). US Patent 3,849,069. 19 Nov 1974. Filed Date 19 Jun 1972. 10p.

An apparatus and method were developed for the combustion of starting materials containing radioactive isotope tracers. Starting material contained in a special cup-shaped holder is placed in an ignition basket and is burned in a combustion chamber. The combustion products are continuously exhausted from the combustion chamber and passed into an isotope recovery system. An ignition promoter may also be provided to assist in ignition of the cup-shaped holder and the starting material contained therein. (Official Gazette)

10816 APPARATUS FOR PERFORMING ASSAYS ON REACTIONS THAT PRODUCE RADIOACTIVE GASES. Kronick, M. H.; Wilson, S. H. (to Secretary of Department of Health, Education and Welfare). US Patent 3,844,894. 29 Oct 1974. Filed Date 30 Aug 1971. 4p.

A method for performing assays on reactions that produce radioactive gases was developed. Reaction components are placed in the reaction well of an open-bottomed container. The reaction is sealed except for an aperture through which evolved radioactive gases can escape. A tent-like cover of scintillation plastic surrounds the aperture. When the radioactive gases strike the plastic, scintillations will be emitted and may be counted by a standard scintillation counter. This method is particularly useful in performing enzyme assays. (Official Gazette)

Radioactive Waste Treatment

Refer also to abstracts 10509, 10555, 11260, and 12154.

10817 (ARH-SA-190(Rev.)) PROGRESS REPORT ON THE DEVELOPMENT OF MODELS FOR THE DESCRIPTION OF RADIONUCLIDE TRANSPORT IN SOLIDS. Griffing, D. E. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Aug 1974. 98p. Dep. NTIS $8.00.

The development of theoretically based models describing long-term radionuclide transport in solids is presented. Differential relationships containing basic mechanisms of reaction and diffusion are derived. Many of these relationships contain complex interactions between these mechanisms and time variant and/or moving boundaries. (auth)

10818 (ARH-SA-193) IMMOBILIZATION OF SPENT CLADDING HULLS BY CONVERSION TO SILICATE FORMS. Schulz, W. W.; Dressen, A. L.; Hobbick, C. W. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Oct 1974. 43p. (CONF-741086-1). Dep. NTIS $5.25.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

A two-step high-temperature process for converting fuel cladding Zircaloy and stainless steel wastes to immobile silicate forms has been devised and partially demonstrated. This immobilization scheme involves oxidation of the spent cladding materials by reaction with HF-O_2 mixtures at 500-600°C. Fusion of the resulting oxides with appropriate amounts of basalt (or sand), Na_2CO_3, and B_2O_3 at 1200-1400°C yields dense (~2.6 g/cm^3) silicates which dissolve in water at 25°C at rates in the range 10^{-9} to 10^{-5} g/cm^2-day. Although considerable further development work is needed (and strongly recommended), favorable results of the initial tests indicate the proposed immobilization process provides a direct, straightforward method for converting all cladding wastes to a form suitable for safe, long-term storage. (auth)

10819 (BNWL-1844) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, JUNE 1974. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-1830. 26p. Dep. NTIS $4.00.

Progress is reported in the development of a NaOH–Na_2O_2 fusion technique for converting refractory PuO_2 to HNO_3-soluble forms. It was found that dry centrifuge sludge did not ignite during fusion if it were first heated to 800°C. Further data on samples from experiments to determine if ^{137}Cs is released from contaminated surface materials during heating confirm low release values previously reported. An isokinetic probe and flow counting chamber was designed and fabricated for measuring ^{85}Kr. It will be used to evaluate the adequacy of gas mixing in ducts to be sampled. Progress is also reported in studies on storage of high-level liquid radioactive wastes. Routine environmental evaluations are reported. (JGB)

10820 (BNWL-1861) WASTE TREATMENT AND HANDLING PROCESSES. Annual Report. Medge, L. K.; Walter, R. A.; Schiefelbein, G. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1974. Contract AT(45-1)-1830. 45p. Dep. NTIS $4.00.

Laboratory-scale studies were conducted to evaluate pyrolysis and gasification processes for the volume reduction of combustible components found in typical alpha waste mixtures. Volume reduction obtained on pyrolysis of a simulated alpha waste mixture at 700°C was by an approximate factor of 2, while volume reduction of simulated feed with air was by a factor of about 20. It was also found that gasification of simulated wastes produced an inert stable ash, while pyrolysis produced a combustible carbonaceous residue. Both gasification and pyrolysis (700°C) of simulated wastes produced about 40% by weight of condensate. The lab studies also showed that fluxes of NaOH and Na_2CO_3 were effective in retaining chloride in the residue during pyrolysis of PVC. Results obtained on pyrolysis of individual components typically present in alpha wastes are presented in this report. Design of a larger scale pyrolysis-incineration system to handle low level radioactive solid wastes was begun in March 1974, and is continuing at the time of this report. Work during this period concentrated on gathering the pertinent information essential to the design of this facility. Various similar processes were studied, including incineration, pyrolysis, and coal gasification systems, in order to identify the equipment used and its operability. Based on these studies, information from equipment manufacturers, and unique process requirements of the system, preliminary equipment selections were made. A general list of design criteria was developed for use in conceptual and detailed system design. Finally, a flowsheet of the pyrolysis-incineration system was prepared. (auth)

10821 (BNWL-SA-5171) REMOTE OPERATIONS IN NUCLEAR WASTE CONVERSION FACILITIES. McElroy, J. L.; Siemens, D. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 9p. (CONF-741086-5). Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

Processes and equipment for the conversion of calcinated high-level aqueous reactor wastes to a less dispersable form are described. Three techniques for the conversion of these calcinated wastes to a glass product are being evaluated. They make use of a metallic melter utilizing external resistance heat, a ceramic melter utilizing joule heating, and in-can melting. Flowsheets are included for typical dry and wet processes. (JGB)

10822 (HEDL-SA-703) ACID DIGESTION PROCESS FOR TREATMENT OF COMBUSTIBLE WASTES. Cooley, C. R.; Lerch, R. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1974. Contract AT(45-1)-2170. 16p. (CONF-741026-4). Dep. NTIS $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

Acid digestion is a process being developed at the Hanford Engineering Development Laboratory (HEDL) in Richland, Washington, to reduce the volume of alpha-contaminated combustible waste by converting it into a noncombustible residue. Typical waste materials such as polyvinylchloride (PVC), polyethylene, paper and other cellulose materials, ion exchange resin, and all types of rubber are digested in hot (230°C–270°C) concentrated sulfuric acid containing nitric acid oxidant to form inert residues having less than 4% of their original volume. The process is currently being tested in a nonradioactive Acid Digestion Test Unit (ADTU) using all glass equipment. Engineering tests to date have

shown acid digestion to be a potentially attractive method for treating combustible waste materials. (auth)

10823 CHEMICAL TRAP. Dietrich, W. C. (to United States Atomic Energy Commission). US Patent 3,846,256. 5 Nov 1974. Filed date 17 Sep 1973. 4p.

A method for removing fluoride contaminants from nitric acid by adding aluminum ions to the acid to form a non-distillable fluoride complex and distilling purified nitric acid from the solution is presented. (Official Gazette)

10824 CONTINUOUS PROCESS FOR IMMOBILIZING RADIONUCLIDES, INCLUDING CESIUM AND RUTHENIUM FISSION PRODUCTS. Isaacson, R. E.; Brownell, L. E. (to United States Atomic Energy Commission). US Patent 3,849,330. 19 Nov 1974. Filed Date 22 Nov 1972. 10p.

A continuous process for immobilizing radionuclides, including cesium and ruthenium fission products as a complex metallosilicate product which is virtually insoluble and non-leachable in alkaline or neutral environments comprises continuously passing a premix consisting of a source of oxygen, and inert material, a fuel, said fuel having a concentration based on weight of reaction material which is subcritical to continuous ignition reaction, and the radionuclide as a nitrate salt or calcined oxide, into a reactor and reacting by an exothermic thermite type reaction said premix with additional fuel whereby a complex metallosilicate melt is formed, contacting condensate of off gases from said reaction with a mixture of sodium aluminate and sodium silicate or sodium hydroxide and clay materials (e.g., bentonite) at 90°C and atmospheric pressure to immobilize cesium sublimates as cesium aluminosilicate, recycling said cesium aluminosilicate to said reactor as part of said premix, removing noble metal fission products including ruthenium as reduced metal from said complex metallo-silicate melt, and charging said complex metallo-silicate melt into a container for storage. (5 Claims, 1 Drawing Figure) (Official Gazette)

10825 METHOD OF PACKAGING OF RADIOACTIVE WASTES. Cuaz, D.; Eymes, L.; Pottier, P.; Thiery, D. (to Commissariat a l'Energie Atomique). US Patent 3,838,061. 24 Sep 1974. Priority date 16 Mar 1971, France. 4p.

Radioactive wastes previously converted to the state of dry powder are incorporated in a resin that is polymerizable at room temperature. The resin is then copolymerized with a monomer in order to obtain a solid which exhibits high leach resistance and long-term retention of radioactivity. (Official Gazette)

10826 COMPARING COSTS OF TREATING LOW-LEVEL RADIOACTIVE WASTES WITH ION-EXCHANGE MATERIALS. Rauzen, F. V.; Aleshnya, V. V. At. Energ. (USSR); 37: No. 4, 322-325(Oct 1974). (In Russian).

The results of an economic comparison of costs in treating low-level radioactive wastes with either recoverable or non-recoverable ion-exchange materials are presented. The conditions for obtaining a reduction in cost of at least 0.5 ruble per cubic meter of effluent are given. (auth)

10827 PROCEDURE FOR THE TREATMENT OF RADIOACTIVE CONCENTRATES-CONTAINING LIQUID WASTES INTENDED FOR DISPOSAL. Kausz, I.; Puthawala, A. (to Kraftwerk Union A. G., Muelheim an der Ruhr (F. R. Germany)). German(FRG) Patent 2012785/B/. 17 Jan 1974. 2p. (In German).

1 fig.

The hardening of harmful, in particular radioactive, concentrates is considered. Bone glue or another binding agent is added to the liquid concentrate. By spray drying, a dry powder or granule is obtained, which with further addition of binding agent is transformed into a pressable mass. The equipment to be used for this process is designed to have a closed hot air circuit for drying and a cyclone separator for the dried materials. (GE)

Radioisotope Production

Refer also to abstracts 10624–10626.

10828 (CNEA-EN-39/115) IMPORTANCE OF THE TRANSURANIUM ELEMENTS. Dupetit, G. A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). May 1973. 38p. (In Spanish). INIS.

Transuranium elements are described along with their uses and methods of production. Alternative cycles for reactor produced transuranium elements are quoted. The possibilities of separating plutonium-239, neptunium-237, and figures for the production of neptunium-237 in nuclear fuel from Argentine reactors up to 1985 are given. A proposal is made for installing a facility in which plutonium-238 can be produced on the gram scale together with an estimate of its cost. (INIS)

10829 (IFA-RI-1-1974) CYCLOTRON PRODUCTION OF CARRIER-FREE GALLIUM-67. Frangopol, M.; Pencea, C.; Calboreanu, A.; Frangopol, P. T.; Cincu, E.; Manzatu, I.; Papae, D. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

Gallium-67 for medical applications is produced in the cyclotron from the reaction $^{65}Cu(\alpha,2n)^{67}Ga$. The results of yield measurements of ^{67}Ga as well as of ^{66}Ga, the main radionuclidic impurity, are reported and an irradiation method to improve the $^{67}Ga/^{66}Ga$ ratio is suggested. The procedure of chemical separation is outlined. A chemical separation yield of 85% is routinely obtained. (auth)

10830 (NP-20223) ANNUAL REPORT, 1973. (Institut National des Radioelements, Brussels (Belgium)). 1 Jul 1974. 39p. (In French). Dep. NTIS (US Sales Only) $5.00.

A very brief summary is given of the activity of the Institute with respect to the production of radioisotopes, the development of radiopharmaceuticals, production of radioimmunoassay material, labelling of organic compounds, industrial applications of radioelements, activation analysis, uses of ionizing radiations, and development of counting techniques. Publications by the Institute are tabulated. (JSR)

10831 (UCRL-75782) PREPARATION OF THIN ACTINIDE TARGETS FOR THE SYNTHESIS OF THE TRANSACTINIDE ELEMENTS. Lougheed, R.; Hulet, E. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 27 Sep 1974. 8p. (CONF-741043-3). Dep. NTIS $4.00.

From third annual conference on the nuclear target development society; Chalk River, Ontario, Canada (1 Oct 1974).

The sublimation method proved to be a valuable new procedure for preparing thick, adherent actinide targets having a high chemical purity. Deposition yields are acceptable, especially since the charge material is easily recoverable. Observation of the deposits on different metal substrates, the ESCA data, and free energy calculations indicate that the very good adherence to Be and Al substrates may be due to a surface reaction of the actinide fluoride with the metal substrate to form a thin layer of actinide metal or an intermetallic between the substrate and the deposited fluoride. Physical and chemical analyses of these sublimed deposits is being continued. (auth)

10832 SURVEY OF SHORT-LIVED FISSION PRODUCTS OBTAINED USING THE ISOTOPE-SEPARATOR-ON-LINE FACILITY AT STUDSVIK. Grapengiesser, B.; Lund, E.; Rudstam, G. (Forskningsraadens Lab., Studsvik, Sweden). J. Inorg. Nucl. Chem.; 36: No. 11, 2409-2431(Nov 1974).

Using the OSIRIS facility mass-separated samples containing isotopes of the elements from zinc to zirconium (selenium, yttrium and zirconium as decay products only) and from silver to cerium (lanthanum and cerium as decay products only) have been prepared, and their decay has been followed by means of $4\pi\beta$-counting or delayed neutron-counting. Half-life data in the range from about 1 sec to about 10 min have been determined for 85 fission products of uranium-235. In addition, results obtained at OSIRIS using other techniques are surveyed. (auth)

10833 CHROMATOGRAPHIC SEPARATION OF SELECTIVE RADIONUCLIDES ON PAPER IMPREGNATED WITH PYROANTIMONIC ACID. Gopal, N. G. S.; Mishra, N. C. (Bhabha Atomic Research Centre, Bombay). pp 111-118 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A separation method for ^{32}P and ^{35}S, ^{45}Ca and ^{90}Sr, ^{59}Fe and $^{58/60}Co$, and ^{203}Hg and ^{204}Tl is described. The method used is the chromatographic separation on paper impregnated with pyroantimonic acid. The preparation of the ion exchange paper from saturated solutions of potassium pyroantimonate and the experimental techniques are described. The results showed that an effective separation of ^{32}P and ^{35}S can be made in either HCl, HNO_3, H_2SO_4 but the use of H_2SO_4 as solvent ensures negligible loss of ^{35}S from adsorption. In the case of ^{45}Ca and ^{90}Sr, the Sr^{2+} is retained at the point of spotting, but the Rf of Ca^{2+} increases sharply with increase of solvent from 0.1N to 1N. ^{59}Fe can be separated from $^{50/60}Co$ at high acid concentrations. For ^{203}Hg and ^{204}Tl, although Tl^+ has an Rf = 0 for HCl, HNO_3, or H_2SO_4, Hg^{2+} has a zero Rf in H_2SO_4 and HNO_3 but a sufficiently high Rf in HCl to allow separation of the two species for further identification. In HCl about 5% of the ^{203}Hg remains at the point of spotting. (JSR)

10834 PRODUCTION OF CARBON-14 FROM PILE IRRADIATED ALUMINIUM NITRIDE. Murthy, T. S.; Biswas, C. R.; Ramaswamy, A. N. (Bhabha Atomic Research Centre, Bombay). pp 251-256 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

A method was developed for the production of carbon-14 from

pile irradiated aluminum nitride. This involves dissolution of irradiated aluminum nitride in phosphoric acid followed by oxidation of the liberated gas to carbon dioxide by heated copper oxide and cobaltous cobaltic oxide. The revised procedure facilitates the separation of carbon-14 into fractions of high-specific- and low-specific activity products. The effect of inactive carbon impurity present in the target on the specific activity of the product has also been studied. (auth)

10835 SEPARATION OF CARRIER-FREE RHODIUM-105 FROM NEUTRON-IRRADIATED RUTHENIUM BY EXTRACTION FROM MOLTEN CYANIDE. Lessing, J. G. V.; Fouche, K. F. (Atomic Energy Board, Pretoria). Anal. Chem.; 47: No. 1, 182-184(Jan 1975).

The addition of nickel to a molten cyanide/liquid tin solvent extraction system provides a selective extraction method for rhodium that can be used for the production of ^{105}Rh. (auth)

10836 METHOD FOR PREPARING TECHNETIUM-99m GENERATORS LOADED WITH FISSION PRODUCT MOLYBDENUM-99. Brown, J. L.; Harris, O. A. (to Mallinckrodt Chemical Works). US Patent 3,830,746. 20 Aug 1974. Filed Date 27 Jul 1972. 6p.

A method for preparing a ^{99m}Tc generator whose sodium pertechnetate eluates have a very low molybdenum and aluminum content is described. Low molybdenum content of the eluate is realized by initially heat-activating the alumina used for the generator column. The heat-activated alumina column is loaded by treating it with a solution of pH 3-4 containing molybdate ions whose molybdenum content consists essentially of ^{99}Mo. (Official Gazette)

Reactor Fuel Reprocessing

Refer also to abstracts 10631, 11104, 11247, 11287, 11556, and 13124.

10837 (BARC-728) STUDIES ON THE TAIL END PURIFICATION OF URANIUM IN THE PUREX PROCESS. Kumar, S. V.; Nadkarni, M. N.; Ramanujam, A.; Venkatesan, M.; Gopalakrishnan, V.; Kazi, J. A. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

Laboratory counter current extraction studies have been carried out using a twelve-stage mixer settler unit with depleted uranium solution obtained from the fuel reprocessing plant at Trombay, to propose an extraction scheme based on 30% tributyl phosphate in shell sol T as extractant for the tail-end polishing of uranium product in the Purex Process streams. Experiments conducted under different AQ-Feed : Organic : Scrub ratios revealed that it would be advantageous to maintain an organic uranium concentration of about 90 g/L in the initial stages of the scrub section. Of the various scrub acidities tried, 0.5M nitric acid scrub was found to be suitable for fission-product decontamination. Satisfactory removal of plutonium could be achieved by 0.01M ferrous sulfamate. (auth)

10838 (BARC-733) DESIGN OF AN AIR PULSER FOR SOLVENT EXTRACTION COLUMNS. Kumar, S. V.; Rajagopalan, S.; Pillai, P. R. R. (Bhabha Atomic Research Center, Bombay (India)). 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

Pulsing of solvent extraction columns using compressed air offer certain advantages over mechanical pulsing. Results of the amplitudes obtained against various pressures at different frequencies on an experimental 50-mm-dia by 2400-mm-long sieve plate column are reported. An empirical design equation was proposed, which takes into account the losses in amplitude due to the instrument probes and other pipes at the bottom of the column. Satisfactory agreement between the experimental and calculated values of amplitudes has been observed. (auth)

10839 (CNEA-EN-32/104) PLANNING A FUEL REPROCESSING PILOT PLANT. Kaufmann, F. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). May 1973. 11p. (In Spanish). INIS.

The possible courses of action for the design of an industrial reprocessing plant are reviewed. These include direct construction, purchase of the know-how, and the construction and operation of a pilot plant. The prospects for a course of action in the Argentine Republic are analyzed. (INIS)

10840 (DOCKET-50201-160) WEST VALLEY REPROCESSING PLANT. License Application, Safety Analysis Report, Supplement 10. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 8 Nov 1974. 308p. Dep. NTIS $18.50.

Supplement 10 contains responses to the USAEC comments and questions on confinement systems and auxiliary systems in the USAEC letter to NFS dated June 28, 1974. (LK)

10841 (JUL-Conf-10, pp 217-240) ELECTROLYTIC Pu/U SEPARATION IN THE PUREX PROCESS; PROGRESS WITH FUEL OF HIGH PLUTONIUM CONTENT. Goldacker, H.; Schmieder, H. (Kernforschungszentrum, Karlsruhe, Ger.). Dec 1973.

Advantages of the electrolytic process for continuous reoxidation of Pu in the Purex process are considered. Design principles underlying the electrolytic multistage mixer-settler and the electrolytic pulsed column realized in a semi-technical scale are described. Results obtained with the electrolytic multistage mixer-settler are discussed. An in-line photometer for monitoring of the plutonium-uranium separation process is briefly discussed. (MCG)

10842 (JUL-Conf-10, pp 241-257) DEVELOPMENT OF IN-LINE-INSTRUMENTATION AND PROCESS CONTROL IN KARLSRUHE. Baumgaertel, G. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). Dec 1973.

From 2nd Info-German seminar; Julich, F. R. Germany (18 Sep 1972).

Important in-line methods and instruments for the process monitoring of the concentrations of U, Pu, and HNO_3 are described. These include: nondispersive x-ray fluorescence, gamma absorptiometry, polarography, density and conductivity measurements, total α counting, and pH measurements. The in-line instruments connect with an interface, which consists essentially of a multiplex system and an analog digital converter. Digitalized va'ues are transferred to the computer via a data channel. The computer resolves the evaluation of the transferred values and the results are printed on a high-speed-printer. (MCG)

10843 FEASIBILITY STUDIES ON CONTINUOUS MONITORING OF FISSION PRODUCT ACTIVITIES IN FUEL REPROCESSING STREAMS. Marathe, S. G.; Rao, V. K.; Bhargava, V. K.; Iyer, R. H. (Bhabha Atomic Research Centre, Bombay). pp 65-72 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Feasibility studies were made of a γ monitoring system for fuel processing streams. The system is based on the principle of selective attenuation of γ rays by Pb absorbers of different thickness. It consists of a flow cell through which the process solution is continuously passed, a shielded NaI(Tl) detector system mounted on a movable trolley, and an electrical readout system. Static experiments with the system on two- and three-component mixtures containing $^{144}Ce(^{144}Pr)$, $^{106}Ru(^{106}Rh)$, $^{137}Cs(^{137m}Ba)$, and $^{95}Zr + {}^{95}Nb$. The system can be applied with an accuracy of ±15 to 20% for two- and three-component mixtures. For four-component systems the results were unsatisfactory. (JSR)

10844 METHOD TO SUPPRESS THE PRECIPITATION OF FLUOROZIRCONATE. Newby, B. J.; Rhodes, D. W. (to USAEC, Washington, D. C.). German(FRG) Patent 2333642/S/. 24 Jan 1974. 8p. (In German).

When zirconium alloy fuels are reprocessed, calcium nitrate must be added to the aqueous fluoride solutions before the calcination process in order to prevent the volatility of the fluoride during calcination. Thus a calcium fluorozirconate gel is formed, which greatly inhibits the transport of the waste solutions by storage and blacking in pipelines and spraying nozzles. In order to prevent the formation of the gel and to delay the precipitation, boric acid or borate (solid or in aqueous solution) is added to the waste solution. The calcium fluorozirconate, which is precipitated in the presence of borates, is in granular form and can be distributed or deposited without any trouble for transport through pipelines. (GE)

10845 RECOVERY OF FISSION-PRODUCED TECHNETIUM, PALLADIUM, RHODIUM, AND RUTHENIUM. Moore, R. H. (to United States Atomic Energy Commission). US Patent 3,848,048. 12 Nov 1974. Filed date 12 Jul 1973. 4p.

The fission-produced technetium and the platinum metals, palladium, rhodium and ruthenium, are recovered from an aqueous acidic fuel reprocessing waste solution and separated from each other by contacting the waste solution sequentially with a series of beds of carbon, each bed having adsorbed thereon a different chelating agent specific for the metals to be recovered, whereby the metal ions are selectively chelated and removed from the waste solution. (Official Gazette)

10846 METHOD OF REPROCESSING NUCLEAR FUELS. Anderson, R. N.; Parlee, N. A. (to Secretary of the Navy). US Patent 3,843,766. 22 Oct 1974. Filed Date 9 Dec 1969. 4p.

A method of dissolving spent metal nuclear fuel in tin and precipitating out a uranium nitride, free of the fission products, by reaction of the uranium contained in the spent fuel with nitrogen is described. The uranium nitride is then heated and subjected to a vacuum to remove the nitrogen and leave only the pure uranium. (Official Gazette)

CONTROLLED THERMONUCLEAR RESEARCH

10847 (AD-779749) SOVIET DEVELOPMENTS IN LASER FUSION. Hibben, S. G. (Informatics, Inc., Rockville, Md. (USA)). 8 Mar 1974. Contract F44620-72-C-0053. 159p. (AFOSR-TR-74-0783). NTIS $5.00.

A collection of abstracts on significant Soviet work in laser fusion, dating from approximately 1969 to the present is presented. The material was selected from the Informatics, Inc. serial publication bibliography of Soviet laser developments, and includes articles directly dealing with fusion as well as related studies by authors active in the fusion field. The abstracts are grouped into experimental studies (plasma kinetics, plasma spectroscopy, laser design), and theoretical studies. A comprehensive bibliography and a first-author index are appended. (auth)

10848 PLASMA PHYSICS INDEX. Volume 9, No. 9, 1974. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 115p.

10849 PLASMA PHYSICS INDEX. Volume 9, No. 10, 1974. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 139p.

10850 PLASMA PHYSICS INDEX. Volume 9, No. 11, 1974. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 184p.

10851 TECHNOLOGY INDEX FOR PLASMA PHYSICS RESEARCH AND FUSION REACTORS. Volume 8, No. 10, 1974. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 45p.

10852 TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. Volume 8, No. 11, 1974. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 48p.

Plasma Confinement and Heating

Refer also to abstracts 10971, 10976, 10989, and 11006.

10853 (AD-783036) INTERIM REPORT ON FOKKER–PLANCK STUDIES OF TWO-COMPONENT-TORI. Winsor, N. K.; Gardner, J. H.; Wagner, C. E.; Boris, J. P. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 24p. (NRL-MR-2833). NTIS $3.00.

The two-component-torus concept was studied for transient beam injection into a target plasma with impurities and losses. Two figures of merit are calculated for various beam target parameters to show the sensitivity of TCT performance to these parameters. The time dependences of important parameters are presented for a representative case. (auth)

10854 (CEA-R-4362) HEATING OF MATTER BY A POWERFUL LASER BEAM. Floux, F. (CEA Centre d'Etudes de Limeil, 94 – Villeneuve-Saint-Georges (France)). Oct 1974. 178p. (In French). Dep. NTIS (U. S. Sales Only) $12.00.

Thesis. Submitted to Grenoble Univ. (France).

The heating of matter by a powerful laser beam to temperatures up to several millions of degrees is possible provided that the total number of heated particles could be limited in the interaction processes. The heating mechanisms depend mainly on the power flux density applied to the plasma, its time-dependent variation and the nature of the target. The investigations were restricted to a solid hydrogen or deuterium target which have been found the most appropriate for strong heating. Experimental and theoretical studies were conducted to analyze the radiative deflagration mechanism phenomena for power flux densities up to a few 10^{12} W/cm^2. For upper values, the energy transfer by electron thermal conduction allows the plasma temperature to reach values of 10 millions of degrees. Evidence is given for nuclear DD reactions occurring in the heated plasma. (auth)

10855 (CONF-741105-42) NEUTRAL BEAM INJECTION EXPERIMENTS IN ORMAK. Berry, L. A.; Bush, C. E.; Dunlap, J. L.; Edmonds, P. H.; Jernigan, T. C.; Lyon, J. F.; Murakami, M.; Wing, W. R. (Oak Ridge National Lab., Tenn. (USA)). [nd.] 11p. (IAEA-CN-33/A5-2). Dep. NTIS $4.00.

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Two energetic (each ~26 kV, 100 kW) neutral beams were used to supplement the larger ohmic heating of the Oak Ridge Tokamak (ORMAK) plasma. Long, constant discharge-current times and beam pulse lengths permitted an essentially equilibrium study of both plasma heating and other effects due to neutral beam injection. Both coinjection (beam parallel to the discharge current) and counterinjection (anti-parallel to the discharge current) were studied. Injection perturbs the plasma density and hence the electron-ion heat transfer, an effect which must be taken into account in evaluating the ion heating due to beam power input. The observed ion temperature increases with coinjection are in agreement with theoretical predictions both in magnitude ($\Delta T_i/T_i$ ranging from from 40% to 10%) and in scaling with plasma density. Measurements of parallel and perpendicular beam ion energy distributions are in agreement with theory, indicating little charge-exchange beam power loss, an effective ionic charge (Z) ~4, and significant beam energy transfer to the plasma. While net electron heating is sometimes observed with coinjection, the main effect of injection on electrons is to alter the radial distributions of electron temperature and density. Counterinjection was found to be much less effective than coinjection in plasma heating and to have a generally deleterious effect on the discharge parameters, stability, and confinement. (auth)

10856 (COO-2059-40) TWO-DIMENSIONAL SIMULATION OF LOWER HYBRID RESONANCE HEATING. Emery, M. H.; Joyce, G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jul 1974. 42p. Dep. NTIS $5.25.

The response of a magnetized plasma to excitation by an external longitudinal electric field oscillating near the lower hybrid frequency is examined by numerical simulation. A two-dimensional, electrostatic, finite-size particle code is used with the ion motion described by standard particle-in-cell methods and the electrons simulated in the guiding-center approximation. The guiding-center model removes the electron mass from consideration and all time scales are measured in units of the inverse ion plasma frequency. An examination of the parameters that control the ion heating lead to the following conclusions: (1) the heating mechanism is not a collisional process, (2) the ion heating rate reaches a maximum for $\lambda \equiv k_\parallel^2 \rho_{ci}^2 \simeq 1$, (3) the heating rate and final temperature are improved for frequencies slightly greater than the lower hybrid frequency, (4) the ion heating is improved for low densities ($\omega_{ci}/\omega_{pi} > 1$), (5) satellite modes appear on both sides of the dominant mode in the frequency spectrum, and (6) the external field excites a normal mode of the system which leads to ion trapping and a further increase in kinetic energy. (auth)

10857 (LA-5743-MS) HYDRODYNAMICS AND BURN OF OPTIMALLY IMPLODED DT SPHERES. Mason, R. J.; Morse, R. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 17p. Dep. NTIS $4.00.

The phenomenology of optimized laser-driven DT sphere implosions leading to efficient thermonuclear burn is reviewed. The optimal laser deposition profile for spheres is heuristically derived. The performance of a 7.5-μg sphere exposed to its optimal 5.3-kJ pulse is scrutinized in detail. The timing requirements for efficient central ignition of propagating burn in the sphere are carefully explored. The difficulties stemming from hyperthermal electron production and thermal flux limitation are discussed. The optimal pulse parameters are given for spheres with masses ranging from 40 ng to 250 μg, requiring from 50 J to 150 kJ of input energy, and the corresponding optimal performance levels. The dependence of pellet compression, heating and burn performance on the pulse energy, time scale, exponential rise rate, peak power and intensity, wavelength, and on the degree of flux limitation is all systematically described. (auth)

10858 (PF-3-73) INTERACTIONS NEAR THE CHARACTERISTIC FREQUENCIES IN A BEAM-PLASMA SYSTEM OF THE REGIONAL MAGNETIC FIELD. Sinman, A.; Sinman, S. (Ankara Nuklear Arastirma Merkezi (Turkey)). Nov 1973. 11p. (In Turkish). INIS.

The beam-plasma interaction resonances were analyzed depending upon the beam current I_D, gas pressure p, and field intensity H_z. The results are discussed. It was observed that the field intensity value of the interaction resonance belonging to the ω_{ce} frequency as determined with the spectrum analyzer was equal to the field intensity at a distance from the principal plane. (auth)

10859 (SFTI-4) EFFECT OF LONGITUDINAL ALTERNATING ELECTRIC FIELD ON THE CONFINEMENT OF LOW-COLLISION PLASMAS IN THE STELLARATOR. Demirkhanov, R. A.; Il'inskii, S. E.; Podlesnyi, G. G.; Stotland, M. A.; Ten, Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi. Fiziko-Tekhnicheskij Inst.). 1974. 37p. (In Russian). Dep. NTIS (U. S. Sales Only) $5.00.

The effect of a longitudinal high-frequency electric field on the containment of a low-collision plasma in the double stellerator RT-2 was studied. The plasma was created by two methods—external injection and uhf discharge. The frequency and amplitude of the longitudinal hf electric field were selected so that the larger part of the localized electrons were converted into transelectrons. (auth)

10860 (UCID-16616) EFFECT OF EXTERNAL PLASMA ON SIMPLE MIRROR REACTOR Q. Logan, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1974. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

The plasma energy drain incurred by the presence of cold plasma outside the mirrors of a simple mirror reactor is calculated as a function of ϵ (ϵ is defined as the density of external cold plasma divided by the density of hot interior plasma). The resultant lowering of the reactor Q (Q is defined as fusion power divided by injected power) is shown to be significant ($Q < 1$) for $\epsilon > 5 \times 10^{-3}$, with a maximum reduction in Q by a factor of 7 as $\epsilon \to 1$. (auth)

10861 HIGH POWER FUNDAMENTAL AND HARMONIC RESONANT ION CYCLOTRON HEATING IN A MIRROR MACHINE. Clark, R. W. (Univ. of Texas, Austin); Swanson, D. G.; Korn, P.; Sandel, F.; Robertson, S.; Wharton, C. B. Phys. Fluids; 17: No. 6, 1322-1328(Jun 1974).

Radio frequency heating at powers up to 1 MW and pulse widths of ~700 μsec was applied to a turbulently preheated hydrogen plasma in a large pulsed mirror machine. Energy analysis of charge exchange neutrals indicates that resonant heating occurred when the radio frequency matched either the ion cyclotron frequency or one of its harmonics. The behavior of the induced rf fluctuations in the plasma was observed by means of microwave scattering. These measurements show resonance phenomena and the presence of rf fluctuations at harmonics of the rf heating frequency. Diamagnetic loop measurements indicate that $310 \leq (T_e + T_i) \leq 380$ eV as a result of the heating, while measurements of the ion energy distribution by charge exchange energy analysis shows the ion energy distribution to be non-Maxwellian with a low temperature component of $T_i \sim 320$ eV. Microwave interferometer measurements indicate densities of ~2 to 3×10^{13} cm^{-3}. (auth)

10862 PLASMA CONFINEMENT IN MULTIPLE-MIRROR SYSTEMS. I. Theory. Makhijani, A.; Lichtenberg, A. J.; Lieberman, M. A.; Logan, B. G. (Univ. of California, Berkeley). Phys. Fluids; 17: No. 6, 1291-1301(Jun 1974).

For an intermediate mean free path regime where $\lambda \ll L$, the system length, but where $\lambda \gg l_m$, the scale length of the magnetic field variation, it is found that the confinement time τ_{mm} of ions in a multipole mirror system scales quadratically with the system length. When either inequality is not satisfied, a transition is found to a scaling which is more closely proportional to L. For the high density regime this corresponds to magnetohydrodynamic flow. By comparison with numerical and experimental results a criterion is found for the transition from the quadratic to the linear scaling. The value of $\tau_{mm} = ML^2/(2l_c\bar{v})$ found from diffusion theory is in good agreement with a more accurate analytic treatment which is valid in the limit of $\lambda/M \ll l_c$, where M is the mirror ratio, l_c is the cell length, and $\bar{v}$ is the average ion velocity. Good agreement is also obtained with a self-consistent numerical computation. (auth)

10863 PLASMA CONFINEMENT IN MULTIPLE MIRROR SYSTEMS. II. Experiment and Reactor Calculation. Logan, B. G.; Brown, I. G.; Lichtenberg, A. J.; Lieberman, M. A. (Univ. of California, Berkeley). Phys. Fluids; 17: No. 6, 1302-1313 (Jun 1974).

A multiple mirror experiment confirms the predictions of the theory that the axial confinement time exceeds that of a single mirror of the same length, and that the confinement scales as L^2, where L is the system length. The experiment indicates that the improved confinement occurs in an intermediate mean free path regime in which the mean free path for scattering out of a loss cone is of the order of a cell length. The absolute value of the axial confinement is smaller than the optimum confinement predicted from the theory by a factor between two and three, which is accounted for by the deviation of experimental parameters from optimum conditions. The scaling of the confinement time with mirror ratio is also investigated. A reactor calculation using the multiple mirror confinement time gives $Q_E = 2$ for a 400-m system with 3000-MW(e) output. (auth)

10864 NEW CLASS OF TOROIDAL EQUILIBRIA, WITH APPLICATION TO THE SCREW-PINCH AND TOKAMAK. Misguich, J. H. (CEN de Fontenay-aux-Roses, France). Plasma Phys.; 16: No. 9, 823-833(Sep 1974).

A new class of MHD toroidal equilibria is presented here, and the general solution is given to the first order term in the curvature. Two applications are made. The first one concerns the external medium of the Screw-Pinch and yields a new expression for the displacement of the plasma. The second example describes a resistive soluble model for the Tokamak, and yields a reasonable prediction of the energy confinement time. (auth)

10865 CONVECTION OF THE PLASMA IN THE TOKAMAK. Kadomtsev, B. B.; Pogutse, O. P. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2056-2064(Jun 1974). (In Russian).

It is shown that in a current-carrying plasma allowance for finite conductivity may lead to development of a nonlinear convective flow related to local overheating of separate plasma filaments. The heat removal time due to the convection is of the order of the skin time. (auth)

10866 STABILITY BOUNDARIES FOR TEMPERATURE AND DENSITY GRADIENT FLUTE MODES IN MIRROR MACHINES. Abhyankar, V.G.; Simon, A. (Department of Mechanical and Aerospace Sciences, University of Rochester, Rochester, New York 14627). Phys. Fluids 17: No. 11, 2040-2047 (Nov 1974).

A set of fluid equations is used to determine the stability boundaries for flute instability of a plasma in a nonuniform magnetic field, in the presence of simultaneous density (δ') and temperature (λ') gradients. The resulting surfaces in δ', λ', P space (P proportional to plasma density) show the various conditions leading to instability for either magnetic wells or ordinary mirrors. It is demonstrated that a modified form of the fluid equations given by Varma is most appropriate for high-energy injection plasmas. A temperature gradient in the same direction and of the same magnitude as the magnetic field gradient is always destabilizing. (auth)

10867 NONRESONANT PLASMA HEATING BY A SINGLE MODE, BEAM-PLASMA INSTABILITY. Conrad, J.R.; Levine, J.S.; Walsh, J.E. (Department of Physics and Astronomy, Dartmouth College, Hanover, New Hampshire 03755). Phys. Fluids 17: No. 11, 2144-2146 (Nov 1974).

The variation of plasma temperature with the frequency and intensity of a single mode in a beam-plasma system has been measured. The results agree with the quasi-linear theory of the beam-plasma interaction. (auth)

10868 TURBULENT HEATING OF IONS IN A TOROIDAL EXPERIMENT. Hirose, A.; Mah, S.Q.; Skarsgard, H.M.; Strilchuk, A.R. (Physics Department, University of Saskatchewan, Saskatoon, Saskatchewan, Canada). Phys. Fluids 17: No. 11, 2147-2148 (Nov 1974).

Previous ion temperature measurements are interpreted in terms of the stochastic heating resulting from the finite correlation time ($\tau_c \sim 2\pi/\omega$) of the observed ion acoustic turbulence. The damping of the fluctuations appears to be provided largely by the ions. (auth)

10869 INITIAL HEATING RATE OF A DROPLET IN A SPHERICAL MICROWAVE CAVITY. Garelis, E. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 17: No. 11, 2002-2008 (Nov 1974).

A simple analytical relationship for the Q of a resonant spherical cavity with a central droplet is derived assuming superconducting cavity walls. In this case Q = (ω × stored energy)/(power loss) where power loss refers to the energy rate delivered to the central droplet. It is assumed that the skin depth δ, is small compared with the droplet radius a, and that the wavelength, $\lambda = 2\pi c/\omega$, be small compared with the cavity radius b, and large compared with the droplet radius. The equation is $Q = (bc^2)/(a^2\delta\omega^2)$. It is shown that in the case of conducting cavity walls a short wave length minimizes the wall losses. (auth)

10870 STRONG ION HEATING IN A MAGNETIC NEUTRAL POINT DISCHARGE. Ohyabu, N.; Okamura, S.; Kawashima, N. (Institute of Space and Aeronautical Science, University of Tokyo, Komaba, Meguro-ku, Tokyo, Japan). Phys. Fluids 17: No. 11, 2009-2013 (Nov 1974).

A sudden anomalous increase in the plasma resistivity at a magnetic neutral point is observed which results in fast energy dissipation and strong plasma heating. It appears earlier and its magnitude increases as (i) the plasma density is decreased, (ii) the discharge plasma current is increased, or (iii) the external quadrupole magnetic field is increased. When the sharp rise in the resistivity appears, the electron and ion temperatures rise abruptly up to the range of several keV within 0.5 μsec and about 10% of the initial energy stored in the capacitor (for the plasma current excitation) is converted into the ion thermal energy. This strong and efficient ion heating cannot be explained by a simple classical process and the role of turbulent waves should be important. (auth)

10871 THEORY AND EXPERIMENT ON RADIO-FREQUENCY PLUGGING OF MAGNETICALLY CONFINED PLASMA IN AN OPEN-ENDED SYSTEM. Watari, T.; Hiroe, S.; Sato, T. (Institute of Plasma Physics, Nagoya University, Nagoya, Japan); Ichimaru, S. Phys. Fluids 17: No. 11, 2107-2115 (Nov 1974).

The theory of the rf plugging of a magnetically confined plasma in an open-ended system is presented; it takes explicit account of the collective effect brought about by the dynamic screening action of the plasma. The theory predicts a maximum efficiency of the rf plugging at an optimum frequency corresponding to a zero of the longitudinal dielectric constant. The plugging efficiency is calculated as a function of the plasma density, the strength of the rf field, and the intensity of the magnetic field. These theoretical predictions are compared with experimental observations, demonstrating satisfactory agreement in over-all features. The results provide a useful scaling law associated with the concept of the rf confinement. The theory also offers an explanation for the discrepancy between the experimental values of the optimum frequency and those predicted by a conventional theory based on an individual-particle model. (auth)

10872 MULTIPHOTON CYCLOTRON RESONANCE ABSORPTION OF LASER RADIATION. Seely, J.F. (Department of Physics and Astronomy, University of Tennessee, Knoxville, Tennessee 37916). Phys. Rev. A 10: No. 5, 1863-1867 (Nov 1974).

The laser heating of plasma electrons in a uniform static magnetic field via the inverse bremsstrahlung process is considered. A kinetic equation is derived, and the change in kinetic energy of the electrons is calculated. For laser radiation propagating parallel to the magnetic field and incident on cold electrons, it is found that multiphoton processes are dominant when the laser frequency is near the electron cyclotron frequency. The multiphoton absorption coefficient is found to decrease as the laser frequency approaches the electron cyclotron frequency. The presence of the magnetic field reduces the intensity threshold above which multiphoton absorption occurs. (auth)

10873 NUMERICAL SIMULATION STUDIES OF A TURBULENT HEATING EXPERIMENT. Whitfield, D.W.A.; Skarsgard, H.M. (Physics Department, University of Saskatchewan, Saskatoon, Saskatchewan, Canada). Phys. Fluids 17: No. 12, 2255-2260 (Dec 1974).

Electrostatic, one-dimensional, numerical plasma simulations have been used to study results from the University of Saskatchewan turbulent heating experiment. In a simulation plasma with an initial sinusoidal density perturbation (approximating the effect of a bumpy magnetic field parallel to the plasma current in the experiment), the application of a constant external electric field can cause the electrons to split into two groups, one freely accelerating and the other trapped near zero velocity in a potential well resulting from the inhomogeneous ion density. The ensuing electron-electron instability can cause reduced acceleration and heating of the electrons, even when the ions are infinitely massive. This process appears to have a role in the experiment although close quantitative agreement cannot be claimed. A common and important feature of the simulations was the tendency of all observed instabilities to heat the electrons at a rate which maintained the ratio of electron drift to thermal velocity near unity. This heating rate has been observed in the experiment. (auth)

10874 RANDOMIZATION OF THE GYRATION PHASE THROUGH BINARY COLLISIONS. Momota, H.; Takizuka, T. (Faculty of Engineering, Kyoto University, Kyoto, Japan). Phys. Fluids 17: No. 12, 2290-2291 (Dec 1974).

A criterion for the gyration phase being well randomized through binary collisions for a bounce motion of a charged particle in a magnetic mirror is investigated theoretically. The resultant criterion is seen to be easily satisfied even for the case of very rare collisions. (auth)

10875 EXPERIMENTAL STUDY OF ANOMALOUS ABSORPTION OF ELECTROMAGNETIC WAVES AND HEATING OF COLLISIONLESS NONMAGNETIZED PLASMA. Barinov, V. I.; Gekker, I. R.; Sergeichev, K. F.; Sizukhin, O. V.; Trofimov, V. E. Tr. Fiz. Inst., Akad. Nauk SSSR; 73: 37-86(1974). (In Russian).

Experiments were made on the interaction of super-high-frequency waves with plasma near the critical concentration. With a potential of the super-high-frequency field of 10 to 100 V/cm, there was an anomalously strong absorption of waves, accompanied by intensive heating of the completely ionized collisionless plasma. There was a dependence, illustrating the super-high-frequency absorption in the plasma, of electron heating and disintegration of the restricted plasma. These phenomena are related to development of parametric instabilities in a plasma located in a strong super-high-frequency field. (tr-auth)

10876 OPTIMIZATION OF BEAT FREQUENCY PLASMA HEATING NEAR THE ELECTRON CYCLOTRON FREQUENCY. Capjack, C. E.; James, C. R. (Univ. of Alberta, Edmonton). Can. J. Phys.; 52: No. 22, 2223-2227(15 Nov 1974).

The plasma power absorbed from a beat frequency wave generated through the nonlinear mixing of two laser beams may be optimized by the utilization of an electron current resonance. The parametric dependence of the plasma power absorption near an electron resonance is examined together with experimental considerations for the case where CO_2 lasers are used. (auth)

10877 PROCESS AND DEVICE FOR HEATING A PLASMA AND DEVICE MAKING USE OF THIS PROCESS. Consoli, T. (to Commissariat a l'Energie Atomique). French Patent 2,174,678. 6 Mar 1972. 18p. (In French).

A superconductive resonant structure is energized by means of a hyperfrequency generator. A deuterium icicle is pre-ionized by means of a CO_2 laser. The deuterium ionization causes the overvoltage of the resonant structure to drop abruptly and hyperfrequency electromagnetic energy discharges into the plasma. The resonant structure comprises a so-called experimental first cavity and a plurality of cavities which are both inter-coupled to the experimental cavity. (FR)

10878 RADIO FREQUENCY ASSISTED MAGNETIC MIRROR. Howell, R. B. Austin, TX; Univ. of Texas (1972). 134p. University Microfilms Order No. 74-24,882.

Thesis (Ph. D.).

A radio frequency assisted magnetic mirror was used to study the possibility of enhanced plasma reflection in a magnetic bottle. A singly ionized lithium plasma was created which had its main energy along the axis of the magnetic bottle. Radio frequency electric fields were applied by means of a capacitor plate antenna located at the neck of the bottle. Various diagnostic equipment was used to detect the plasma as it passed through the mirror or was reflected back. The physical basis of this experiment was that particles can be given additional perpendicular energy which causes them to be turned by the gradient of the magnetic field. To supply the electric field at the site of the particle, a plasma resonance frequency was used. The resonance theoretically also allows the fields to become large which is necessary away from the cyclotron resonance. The resonance used was the lower hybrid frequency. Theoretically, this resonance condition was established for a capacitor plate antenna by solving Laplace's equation in the vacuum region, Poisson's equation in the plasma, and applying the proper boundary conditions. This was done for both one dimensional and two dimensional geometries. Langmuir probes were used to obtain the density and electron temperature of the plasma. A microwave cavity and a microwave interferometer were used as independent checks on the plasma density. An electrostatic velocity analyzer was used for obtaining the range of ion energies and for detecting the plasma which passed through the mirror. Data was taken that exhibited the approximate frequency dependence of plasma reflection. This was taken in the frequency range of 1 to 17 MHz. A threshold voltage of rf was found for obtaining reflection at some frequencies. A rough physical picture was given for the return times of plasma at various frequencies and rf voltages. Density measurements were made of the reflected plasma which indicated a high percentage of reflection at the plates for some frequencies. The lower hybrid condition was found to fall in the density profile for the cases in which reflection was found. (Diss. Abstr. Int., B)

10879 PLASMA CONFINEMENT IN A MIRROR MACHINE WITH AN END STOPPER. McHarg, B. B. Jr. Austin, TX; Univ. of Texas (1974). 146p. University Microfilms Order No. 74-24,903.

Thesis (Ph. D.).

The mirror machine concept for a fusion reactor was one of the earliest and still one of the most attractive designs proposed. However collisional losses from the ends of a mirror machine place substantial restrictions on the confinement time of a plasma in such a device. Because of these losses it would be difficult to build a fusion reactor based on a mirror machine. One method proposed to improve the viability of a mirror machine reactor is to somehow reduce the end losses by some means other than the magnetostatic field (for example by using rf or dc electric fields). Such a device is called an end stopper and it has the effect of changing the loss cone of the usual mirror machine into a loss hyperboloid (two sheet). The end losses from a mirror machine with an ideal, perfectly reflecting end stopper are studied by numerically solving the Fokker-Planck equation. The mirror and end stopper are assumed to be a square well system and only decay of the system is considered. A number of simplifying assumptions are made including neglect of the electron equation (reasonably valid if T_i is much larger then T_e) and ambipolar potential (which may be negligible anyway if both electrons and ions are reflected by the end stopper). The isotropic effective potential approximation is also made in the differential equation. The equation is solved

numerically using the Peaceman-Rachford ADI differencing scheme. No attempt is made here to propose any particular type of end stopper. What is important is how the theoretical stopper affects the distribution function as compared to a mirror machine with no end stopper, and also how much the confinement time (time to decay to half initial density) is increased over the unstoppered mirror for the same conditions. From numerical results the confinement time is found to follow the form $\tau_c = \{3.86T_o^{\frac{1}{2}} B(\varphi_s/T_o)\ln[RA(\varphi_s/T_o)]\}/[n_o m^{\frac{1}{2}} \Gamma(n_o, m, T_o)]$, where B and A are increasing functions of φ_s/T_o and equal to one for $\varphi_s/T_o = 0$. For $\varphi_s/T_o = 1$ there is approximately a four fold increase in τ_c over the unstoppered mirror. Some useful analytic approximations have been found for B and A. An application of the end stopper to a model of a mirror machine power plant indicates that an end stopper would have two beneficial effects. It would reduce the circulating power within the plant and decrease the range of energies to be handled by a direct converter system. (Diss. Abstr. Int., B)

10880 VLASOV EQUILIBRIUM IN AN ELECTROSTATICALLY STOPPERED MAGNETIC SPINDLE CUSP MACHINE. Brunel, F.; Lafrance, G.; Burkhardt, H.; Gregory, B. C. (Univ. of Quebec, Varennes). Can. J. Phys.; 52: No. 21, 2157-2163(1 Nov 1974).

Numerical equilibrium solutions were obtained for electrons and deuterium ions in a magnetic spindle cusp geometry combined with a stoppering electrostatic field. Each species of particles is given a distribution function in terms of the constants of motion; such functions are solutions of the Vlasov equation. The Poisson equation is solved with charge distributions calculated from the moment of these distribution functions. Magnetic fields are not treated self-consistently. The calculations are two-dimensional. The parameters characterizing the plasma such as temperature and size, and the magnetic and electric field strengths are varied to a limited extent. The equilibrium solutions are presented as profiles of densities and potential at certain sections of the machine and as equi-density contours. (auth)

10881 CALCULATIONS OF PLASMA BUILD-UP IN A BASEBALL-SEAM TYPE DEVICE. Dnestrovskii, Y. N.; Kostomarov, D. P.; Susdalzeva, L. F.; Golovin, I. N.; Panov, D. A. (Moscow State Univ.). Plasma Phys.; 16: No. 11, 1101-1103 (Nov 1974).

The dynamics of plasma accumulation in a baseball device by means of neutral beam injection is studied by numerical methods. It is shown that by optimizing the choice of injection direction a dense plasma kernel is formed in the central part of the device. This kernel facilitates the transition from plasma build-up by means of Lorentz ionization to that by ionization on the plasma already formed. (auth)

10882 THOMSON SCATTERING FROM A CO_2–LASER–HEATED MAGNETICALLY CONFINED PLASMA. Pearlman, J.S.; Pietrzyk, Z.A.; Vlases, G.C. (University of Washington, Seattle, Washington 98195). Appl. Phys. Lett. 26: No. 1, 3-5 (1 Jan 1975).

Measurements of the interactions of CO_2 laser radiation with a theta pinch plasma have been made using laser scattering as a diagnostic technique. The plasma was heated axially with a TEA CO_2 pin laser. The scattering measurements have shown the time evolution of the laser–heated plasma during and after heating by the "spike" of the CO_2 laser. The energies involved in the change of plasma conditions agree well with the theoretical absorption associated with the inverse bremsstrahlung mechanism. (auth)

10883 HIGH FREQUENCY PLASMA HEATING IN A STRONG MAGNETIC FIELD. Rubenchik, A. M.; Rybak, I. Ya.; Sturman, B. I. (Inst. of Automation and Electrometry, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 4, 1364-1376(Oct 1974). (In Russian).

The nonlinear stage of parametric instability of magnetized Langmuir oscillations in a plasma in a strong magnetic field is studied. It is shown that the major nonlinear mechanism, restricting the oscillation amplitude, is induced scattering by ions. The wave distribution in k-space is shown to be sharply anisotropic. The energy flux in the plasma is calculated. It is shown that the fraction of energy absorbed by the ions is much greater than in a plasma without a magnetic field. (auth)

10884 PLASMA HEATING BY MAGNETOACOUSTIC OSCILLATIONS. Kapitsa, P. L.; Pitaevskii, L. P. (Physics Lab., Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 4, 1410-1421(Oct 1974). (In Russian).

Various mechanisms are considered for energy dissipation in magnetoacoustic waves propagating across a magnetic field in a high-temperature plasma. The dissipation due to ion–ion collisions is calculated for $\omega_s \tau_i \gg 1$. Conditions are indicated for which the dissipation exceeds the ohmic value and the major part of the oscillation energy is transferred to the ions. The feasibility of heating of plasma ions by exciting standing magnetoacoustic waves is discussed. (auth)

10885 TWO DIMENSIONAL STEADY FLOW STRUCTURES IN LASER-SOLID TARGET INTERACTION. Pert, G. J. (Hull Univ., Eng.). Plasma Phys.; 16: No. 11, 1035-1049(Nov 1974).

Due to the variation of laser intensity across the focal spot in a laser–solid target interaction experiment, the shock and deflagration structure produced will be two-dimensional. Flow profiles resulting from this effect are calculated for cases when the deflagration is thin. It is found that steady flow structures with the shock detached or attached to the deflagration may occur. Detailed profiles for the attached case are presented. (auth)

10886 SOME CALCULATIONS OF THE HEATING OF SMALL PELLETS BY LASER RADIATION USING THE SIMILARITY MODEL. Pert, G. J. (Hull Univ., Eng.). Plasma Phys.; 16: No. 11, 1051-1068(Nov 1974).

The validity of the similarity or self-similar model of laser–plasma heating is examined and some criteria relating to the maximum radius of pellets to which it may be applied are derived. Numerical studies of the parametric variation of plasma parameters with laser variation are presented. It is found that substantially increased energies may be expected with CO_2 lasers, compared with Nd:glass. (auth)

10887 THERMAL CONDUCTION EFFECTS IN LASER SOLID TARGET INTERACTION. Pert, G. J. (Hull Univ., Eng.). Plasma Phys.; 16: No. 11, 1019-1033(Nov 1974).

The role of thermal conduction in modifying the characteristics of steady state deflagration structures in laser-solid target interaction is investigated. It is found that even in the case where the thermal conduction is small, the properties of the flow must be modified to include heat transfer to the expansion fan, and two-dimensional gas flow effects. In the case of the thick thermal structure, modified scaling laws must be used. (auth)

10888 STUDY OF THE PRE-IONIZATION OF A FAST TOROIDAL PINCH. Hirano, K. (Nagoya Univ., Japan). Plasma Phys.; 16: No. 11, 1005-1017(Nov 1974).

Techniques for and the mechanisms of the pre-ionization of a fast toroidal pinch system were studied. Among the various techniques tested electron beam injection into the discharge tube is found to be the most satisfactory. A special electron gun capable of delivering 1A was developed. Using this gun, breakdown is possible at pressures as low as 2 mtorr in D_2 gas. In addition to Townsend's α process, it is found that both electron drift due to the toroidal effect and turbulent diffusion caused by the drift dissipative ion-acoustic instability seem to play an important role during the buildup of the discharge in a high E/p, fast toroidal pinch experiment. (auth)

10889 TURBULENT HEATING OF A PLASMA AS A FUNCTION OF ION MASS. Elagin, N. I.; Fanchenko, S. D. Zh. Eksp. Teor. Fiz.; 67: No. 4, 1355-1363(Oct 1974). (In Russian).

Experimental results are presented on turbulent heating and anomalous resistance in a bumpy torus type arrangement. It is shown that the anomalous conductivity measured for hydrogen, argon, and xenon plasmas of equal concentrations is the same in a broad range of variation of the electric field strength. The results may be explained on basis of the ion-acoustic theory of current-driven turbulent heating. (auth)

Plasma Diagnostics

Refer also to abstract 10882.

10890 (AD-777575) DIAGNOSTIC METHODS AND INSTABILITY SUPPRESSION TECHNIQUES FOR A MIRROR GEOMETRY PLASMA WITH RADIAL ELECTRIC FIELDS. Final Report, 1 August 1969–30 June 1973. Martin, J. S.; Andrews, M. L. (Wright State Univ., Dayton, Ohio (USA). Dept. of Physics). Dec 1973. Contract F33615-69-C-1842. 50p. NTIS $3.25.

Theoretical and experimental work on a rotating magnetoplasma in 4:1 mirror geometry is described. The properties of seven plasma sources are summarized. The main plasma source, consisting of a helical Lisitano coil and spiral thermionic filament to create a parabolic potential profile, produced a plasma having appropriate parameters at the center point. A rapid method for determining time-resolved plasma parameters using Langmuir probes, boxcar integrator, memory display unit and minicomputer is described. A theory of collisional drift waves for a partially ionized magnetoplasma with ion temperature not equal to electron temperature is described. (auth)

10891 (AD-783261) CONICAL ELECTROSTATIC PROBE RESPONSE IN A WEAKLY IONIZED GAS FLOW. Final Report.

Bruce, C. F.; Talbot, L. (California Univ., Berkeley (USA)). May 1974. 97p. (FM-74-5; AFOSR-TR-74-1199). NTIS $8.00.

Conical electrostatic probes of lengths 0.153, 0.393, and 1.0 cm were placed in partially ionized argon flows in the laboratory in order to study the use of their current-voltage characteristics in the measurement of ion number densities over a wide range. The ion densities and electron temperatures of the flows were measured with thin cylindrical electrostatic probes, and the neutral properties were determined from impact pressure, stagnation pressure, and stagnation temperature measurements. The current-voltage characteristics of the ion-attracting conical probes were measured and compared to thin and thick sheath theories. Over the whole range of ion densities the measurements agreed reasonably well with the thin sheath theories of Chung and Blankenship (1966) and Denison (1967) which yield explicit expressions for the ion densities in terms of measurable quantities. (auth)

10892 (AEC-TR-7598) ANALYSIS OF ION COMPONENT OF MOVING PLASMA. Zavada, P. I.; Kalmykov, A. A.; Skladnik-Sadovskaya, E.; Tereshin, V. I.; Chebotarev, V. V.; Yakubovskii, V. G. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). Jan 1975. Translation of KHFTI-74-16. 9p. Dep. NTIS $4.00.

The feasibility of determining the parameters of moving plasma on the basis of the energy and mass spectra of the ion component was investigated. The cases of isotropic and nonisotropic ion energy distribution of plasma flow in the center of mass system are examined. The ions for analysis were sampled with a special system for preliminary reduction of the plasma density and separation of the ion component. The possibility of using such a system in experiments on dense plasma flows is discussed in detail. The macrocharacteristics of plasma flow, determined from the energy spectra are compared with the values measured by independent methods in the case of isotropic ion energy distribution in the center of mass system. (auth)

10893 (AEC-TR-7599) MEASUREMENT OF PLASMA POTENTIAL BY PARTICLE BEAMS. Kalmykov, A. A.; Lavrent'ev, O. A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). Jan 1975. Translation of KHFTI-74-17. 20p. Dep. NTIS $4.00.

The method of measuring the plasma potential, space potential, and other parameters of plasma with the aid of heavy ion beams and by changing the charge composition of the probe ions in the plasma, is examined. The plasma potential is determined on the basis of the change of the energy of ions with altered charge, and the space potential is determined on the basis of measurement of the flight time of particles through the plasma space. (auth)

10894 (IPP-1/148) DETERMINATION OF NEUTRAL-PARTICLE DENSITY IN A DEUTERIUM PLASMA BY OPTICAL ABSORPTION-MEASUREMENTS IN THE VACUUM UV. Bergmann, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Sep 1974. 42p. (In German). Dep. NTIS (U. S. Sales Only) $5.25.

The density of neutral deuterium atoms in a deuterium plasma was determined by line-absorption-measurements. A modified theta-pinch served as a continuum light source. The amount of light absorbed in resonance transitions yields the concentration of the neutral particles. This method enables a direct measurement without assumption about the plasma parameters. (auth)

10895 (LA-UR-74-1424) FAST FRAMING AND X-RAY PINHOLE CAMERA TECHNIQUES FOR STUDY OF LASER-GENERATED PLASMAS. Lieber, A. J.; Benjamin, R. F. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 11p. (CONF-741111-1). Dep. NTIS $4.00.

From Electro optics system design conference; San Francisco, California, USA (5 Nov 1974).

A brief description is given of the x-ray pinhole camera system. Pinhole optics maps the object onto a thin plastic fluor in optical contact with the fiberoptics input window of an image intensifier. The image is then electronically amplified and recorded on film in contact with the rear of the intensifier. Proximity focused channel plate intensifiers are used rather than sector focused intensifiers because of their superior resolution for fast gating and shuttering. Some experimental results are described. (MOW)

10896 MICROWAVE PROBING OF A DENSE, HOT, COLLISIONAL MAGNETO-PLASMA. Singh, S.; Gupta, S. C. (Punjab Univ., Patiala, India). Plasma Phys.; 16: No. 10, 993-996(Oct 1974).

A microwave probing technique is suggested for diagnosing hot, dense, collisional magnetoplasma normally found in controlled thermonuclear reaction experiments and other high density industrial plasma devices. For this the dependence of the power reflection coefficient R upon various plasma parameters is needed from which one can build up standard graphs. This dependence was studied using collisional contributions from the Landau and BGK collision modes. (UK)

10897 THEORY OF THE ION-RESONANCE PROBE. Nikolov, N. A.; Mateev, E. S. (Univ., Sofia). J. Phys., D (London); 7: No. 14, 1939-1943(21 Sep 1974).

A study is made, based on the two-component MHD equations, of the effect of a low-frequency averaged force on the DC component of an ion-resonance probe's potential. The final formula for the change of the potential shows a resonance near the ion plasma frequency ωLi. In the frequency range $\omega \ll \omega$ Li, ion-acoustic resonances are found, which makes it possible for the electron temperature T_e to be determined from the experiment. (auth)

10898 INFLUENCE OF INCREASING ELECTRON DENSITY ON RESONANT MICROWAVE RADIATION TEMPERATURE MEASUREMENTS IN A BOUNDED MAGNETOPLASMA. Sahni, O.; Jennings, W. C. (Rensselaer Polytechnic Inst., Troy, NY). Plasma Phys.; 16: No. 9, 887-889(Sep 1974).

An experimental study is described of the effect of increasing discharge current on the Tr vs ω_b/ω data in a bounded magnetoplasma, where Tr is the radiation temperature and ω_b and ω are the electron cyclotron and microwave observation frequencies. The results constitute a direct experimental verification of the prediction by Wright and Bekefi (Wright, B. L. and Bekefi, G., Physics of Fluids, 14, 1971, 1764, 1773), based on computer calculations, that, even though the numerator (total emission terms) and the denominator (total absorption terms) of the general Tr expression may slow a broad maximum elsewhere (e.g., at the hybrid resonance), the velocity-dependent collision frequency manifests itself in additional structure at $\omega_b/\omega = 1$, thereby making Tr resonant only at the electron cyclotron frequency irrespective of electron density. (UK)

10899 NINETY DEGREE RUBY LASER LIGHT SCATTERING FROM A DEUTERIUM DENSE PLASMA FOCUS DEVICE. Mayhall, D. J. T. Austin, TX; Univ. of Texas (1974). 345p. University Microfilms Order No. 74-24,901.

Thesis (Ph. D.).

The D_2 plasma focus is of interest in controlled thermonuclear fusion research because of its high $n\tau$ product, high density, high temperatures, and large neutron yield. The stages of the plasma focus discharge may be classified as the breakdown, inverse pinch, acceleration, implosion, dense pinch, and post dense pinch phases, each of which has been studied by a number of researchers. A summary, albeit not all inclusive, of much of that work is presented. (Diss. Abstr. Int., B)

10900 ELECTRON DENSITY MEASUREMENTS IN COLLISION-DOMINATED PLASMAS. George, T.V.; Denes, L.J. (Westinghouse Research Laboratories, Pittsburgh, Pennsylvania 15235). Appl. Phys. Lett. 26: No. 1, 1-3 (1 Jan 1975).

A simple technique, based on the absorption of far-infrared radiation, is shown to provide direct electron number density data in atmospheric large-volume plasmas. Spatially and temporally resolved measurements of electron density were obtained from a 10-cm plasma over the range $10^{11}-3\times10^{13}$ cm^{-3} using a 337-μm laser source. The measurement configuration allowed a 0.5-cm spatial resolution and a 200-nsec temporal resolution. (auth)

10901 AN X-RAY SPECTROMETER FOR LASER-INDUCED PLASMAS. Cuderman, J.F.; Glibert, K.M. (Sandia Laboratories, Albuquerque, New Mexico 87115). Rev. Sci. Instrum. 46: No. 1, 53-57 (Jan 1975).

A seven-channel K-edge filter spectrometer which uses Si PIN-type diodes has been developed as an x-ray diagnostic tool for laser plasma experiments. The spectrometer is designed to sample the photon energy range from 500 eV to 20 keV. The theory and techniques involved in the application of a K-edge filter-Si diode spectrometer to laser plasma studies are presented. Electron temperatures in plasmas are often determined by the two-foil ratio method. The present work defines conditions under which such a measurement may prove unreliable. Typical absolute x-ray spectra obtained from subnanosecond irradiation of 1000 μ CD_2 spheres with a few joules of laser energy yields 200 eV electron temperatures and a 1% laser to x-ray conversion efficiency. (auth)

10902 TEN-CHANNEL POLYCHROMATOR FOR STUDYING THE SHAPE OF THE SPECTRAL LINES OF A NONSTATIONARY PLASMA. Antipov, S. V.; Nezlin, M. V.; Snezhkin, E. N.; Trubnikov, A. S.; Khanov, I. F. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 852-854(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 193-195(1974).

A ten-channel polychromator based on a STE-1 diffraction spectrograph with a relative aperture 1:15 and a glass-fiber lightguide is described. The polychromator allows investigation of the time variation of the contours of spectral lines having

half-widths ranging from ≃ 0.5 to ≃ 60 Å. The results of the performed experiments are described in which the polychromator was used to determine the density of a pulse plasma according to the Stark broadening of the hydrogen line H_β. (auth)

10903 INSTALLATION FOR TRANSILLUMINATION OF A NONSTATIONARY PLASMA AT A STIPULATED TIME. Tarasov, V. I.; Fishman, I. S.; Shitov, E. I. (Kazan State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 850-851(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 191-193(1974).

An installation is described for the transillumination of a plasma, which allows absorption contours to be obtained in various phases of a low-voltage pulse discharge with a time resolution of 0.15 msec. (auth)

10904 MEASUREMENT OF THE LONGITUDINAL PLASMA-DENSITY GRADIENT. Berezin, A. K.; Belichenko, E. I.; Kiselev, V. A. (Physicotechnical Inst., Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 802-804(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 153-155(1974).

A method is described for measurement of the plasma density in two stipulated cross sections of a plasma column and the density gradient between these cross sections as a function of time. (auth)

Plasma Kinetics (General)

10905 (AD-782052) STUDY ON PROPERTIES OF NONISOTHERMAL ION ACCELERATOR. Kuznetsov, V. V. 25 Jun 1974. Translated by M. Olaechea from pp 114-119 of Plazmennye Uskoriteli, 1973. (FTD-HT-23-1058-74). 14p. NTIS $3.00.

An abstract summarizing the contents of this book previously appeared in NSA. For this abstract see 29:1779. (MOW)

10906 (AD-782085) ACCELERATION OF IONS IN HEAVY-CURRENT ELECTRON BEAMS. Plyutto, A. A.; Suladze, K. S. 25 Jun 1974. Translated by F. C. Vaughn from Plazmennye Uskoriteli, 1973. (FTD-MT-24-1046-74). 15p. NTIS $3.00.

An abstract summarizing the contents of this book appeared previously in NSA. For this abstract see 29:1779. (MOW)

10907 (AD-783289) BEHAVIOR OF PLASMOID INJECTED INTO A RISING MAGNETIC FIELD FOR INITIATING FUSION REACTIONS. Final Scientific Report, 1 February 1969-31 January 1974. Siambis, J. G. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). May 1974. 131p. (AFOSR-TR-74-1225). NTIS $4.75.

Four broad research areas were investigated, i.e., the supersonic-subsonic flow transition and shock formation of a dense plasma stream injected longitudinally along a variable magnetic field; the multiple resonance excitation of a plasma column at the high frequency and low frequency resonances and the related ion temperature enhancement in the presence of a collisional thermalization mechanism; the computer simulation and modeling of the electrical breakdown of a gas, avalance and streamer formation and propagation including gas photoionization; and the study of drift waves in toroidal geometry with various types of shear, and with trapped particles due to the variation of magnetic field along the field lines. (auth)

10908 (AD-783996) INDIRECTLY FUNDED RESEARCH AND EXPLORATORY DEVELOPMENT AT THE APPLIED PHYSICS LABORATORY, FISCAL YEAR 1973. Hart, R. W. (Johns Hopkins Univ., Silver Spring, Md. (USA). Applied Physics Lab.). 1973. Contract N00017-72-C-4401. 161p. (APL-TG-1241). NTIS $5.00.

The indirectly funded research and exploratory development activities of the Johns Hopkins University Applied Physics Laboratory during fiscal year 1973 are summarized. Topics include: amorphous semiconductor physics; applied analysis; applied mathematics; atomic, molecular, and electron physics; chemical kinetics; laser physics; microwave physics; space related physics; plasma physics; satellite related science and technology, and varied exploratory research. (GRA)

10909 (HU-TFT-74-9) BREMSSTRAHLUNG IN A PLASMA UNDER THE INFLUENCE OF A STRONG MAGNETIC FIELD. Virtamo, J.; Jauho, P. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 39p. Dep. NTIS (US Sales Only) $5.00.

The bremsstrahlung emission rate of soft photons in a nonrelativistic plasma, immersed in a magnetic field, is calculated. Attention is focused on the strong field case, whence only transitions between Landau ground levels are to be included. The results of Canuto and Chiu are generalized to an arbitrary direction of photon propagation. Emission in a general direction is found to be far more intense than that in the special cases dealt with by Canuto and Chiu; the transition responsible for this strong emission differs from that playing the dominant role in those special cases. For the calculation, the wave modes in the plasma, are quantized as devised by Harris. The technique of ladder operators is employed to derive the electron wave function, and the pertinent matrix elements. (auth)

10910 (PB-232363) REPORT OF NRL PROGRESS. (Naval Research Lab., Washington, D. C. (USA)). Dec 1973. 67p. NTIS $3.75.

Some of the topics discussed include the following: electronics research, surface-related problems in the electronics area, acoustics, chemistry, communication sciences, computer software, metallurgy, ocean technology, optical physics, plasma physics, and solid state electronics. (auth)

10911 (PF-1-73) CHILD-LANGMUIR AND RICHARDSON-DUSHMAN MODELS IN A MAGNETRON INJECTOR. Sinman, S. (Ankara Nuklear Arastirma Merkezi (Turkey)). Nov 1973. 14p. (In Turkish). INIS.

In beam-plasma system it is desirable that the beam should be moncenergetic and throughout the operating period the beam should remain of constant density. However, the first and the most significant step is to know the Volt-Ampere characteristics. This research investigated tension and temperature saturations at the electron supply of a magnetron-injection 10^{-5} to 10^{-3} torr), with comparisons of test results with Child-Langmuir and Richardson-Dushman models. The research also covers theoretical and experimental discussions of the operating conditions of the electron source during injection of electrons into the beam-plasma system by magnetron influence. (INIS)

10912 THERMAL FLUCTUATIONS OF TWO POINT POTENTIAL DIFFERENCE IN MAGNETOACTIVE PLASMA. Kostin, V. M. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 9, 1261-1268(1974). (In Russian).

The spectral density of the potential correlation function in homogeneous magnetoactive plasmas is obtained. It is shown that the average square of a two point potential difference does not depend on the magnetic field and it tends to a terminal limit with an increase of the distance between the points. Spectral density of the correlation function has a singularity at low and upper hybrid frequencies. (auth)

10913 CONVECTION-REGION SOLUTIONS FOR THE RECONNECTION OF ANTI-PARALLEL MAGNETIC FIELDS OF UNEQUAL MAGNITUDE IN AN INCOMPRESSIBLE PLASMA. Cowley, S. W. H. (Imperial Coll. of Science and Tech., London). J. Plasma Phys.; 12: No. 2, 341-352(Oct 1974).

The flow of a highly conducting incompressible fluid in the convection region surrounding an X-type neutral line is considered. The Sonnerup solution is generalized to include cases in which the in-flowing anti-parallel magnetic fields are of unequal magnitude, and in which the plasmas of the two in-flow regions have unequal density. It is found that there exists no unique solution for a given set of in-flow plasma parameters, but that the out-flowing plasma may exit within a certain range of angles with respect to the in-flow direction, depending on in-flow parameters. (auth)

10914 ANALYSIS OF THE DUOPLASMATRON-TYPE DISCHARGE AS A SOURCE OF MULTIPLY CHARGED HEAVY IONS. Winter, A.; Wolf, B. H. (Gesellschaft fuer Schwerionenforschung, Darmstadt, Ger.). Plasma Phys.; 16: No. 9, 791-811 (Sep 1974).

The yield of multiply charged ions from a steady-state Duoplasmatron ion source was investigated. With some simplifying assumptions regarding the discharge plasma structure, one can calculate the density distribution of various charge states for a given feed material and main discharge parameters. The obtainable yields for highly charged ions can also be estimated. Such calculations were made for the rare gases Ar, Kr, and Xe, and these were compared with experimental results derived from the charge state distributions of extracted ion beams. It is shown that such comparisons show quite good agreement. Experiments with rare gas mixtures further confirm the usefulness of the simple model. It is shown that, besides technological limitations, the attainable yield for highly charged ions is limited by the typical structure of the discharge itself as well as by instabilities in the ion source plasma. For a discharge power of approx. 1 kW well resolved beams of the following charge states were obtained: Ar^{3+}(75μA), Ar^{4+}(1.5 μA); Kr^{4+}(15 μA), Kr^{5+}(0.5 μA); Xe^{6+}(1.5 μA), Xe^{7+}(0.1 μA). (auth)

10915 DIFFUSION OF RESONANCE PARTICLES IN STRONG PLASMA TURBULENCE. Gupta, M. R. (Univ. of Calcutta). J. Plasma Phys.; 12: No. 2, 279-286(Oct 1974).

An expression for the velocity space diffusion tensor (time asymptotic) for resonant particles in the weak-coupling limit of strong plasma turbulence theory is derived. The analysis is based on an improved approximation scheme for the determination of the actual particle trajectories, rather than the determination of 'ensemble averaged particle orbits' with the help of the 'average Vlasov propagator'. Except for numerical factors of order unity, the results agree with those of Birmingham & Bornatici (Birmingham, T. J. & Bornatici, M. 1971 Phys. Fluids, 14, 2239, 1972a Phys. Fluids, 15, 1778, 1972b Phys. Fluids, 15, 1785) both when $\tau_c \to 0$ (τ_c is the correlation width of the fluctuating field as seen by the resonant particles), and when τ_c is finite but small. The paper indicates the limits of this method, as well as those of Birmingham & Bornatici. (auth)

10916 SHEATH ON A PLANE THIN CONDUCTOR PARALLEL TO A HYPERSONIC COLLISIONLESS PLASMA. Chenevier, P.; Dolique, J. M. (CNRS, Grenoble, France). Plasma Phys.; 16: No. 10, 983-991(Oct 1974). (In French).

The sheath on a plane thin conductor parallel to a hypersonic collisionless plasma flow is investigated analytically, experimentally, and by computer simulation. In a linear analytical treatment the finite length obstacle is divided into elementary strips, suitably charged so that they form an equipotential set. To each of them the point charge treatment applies. In the experiment a hypersonic ($v \sim 10^6$ msec^{-1} $n \sim 10^{13}$ m^{-3})H^+, e^- synthesized plasma passes along a plane conductor, biased to a variable voltage. The electric field in the sheath is measured by a deflected transverse electron beam method. Results of both approaches are compared to each other and to a computational lagrangian study. Satisfactory agreement is obtained. (auth)

10917 SPACE CHARGE FIELDS IN AFTERGLOW PLASMAS. Smith, D.; Dean, A. G.; Adams, N. G. (Univ. of Birmingham, Eng.). J. Phys., D (London); 7: No. 14, 1944-1962(21 Sep 1974).

Measurements are described of the temporal and spatial variations of the space charge fields in afterglow plasmas together with parallel measurements of electron density (n_e), positive ion density (n_+), negative ion density (n_-), electron temperature (T_e) and mass-analysed wall currents of both positive and negative ions. In the case of the plasmas containing electrons and positive ions only, it has been shown that the spatial variation of plasma potential (ΔV_s) is related to gradients in the charged particle densities and to the electron temperature via diffusion theory, and no complications in the sampling of positive ion wall currents with an orifice probe arise. For plasmas in which significant concentrations of negative ions exist, the previously observed 'trapping' of negative ions within the plasma occurs, as manifest by a lack of negative ion wall current at early afterglow times followed later by a sudden onset. The probe measurements indicate a continuous diffusive loss of electrons and positive ions during the afterglow, whereas the negative ions remain within the plasma until n_e has fallen to $\lesssim 10^{-2} n_-$ at which point an avalanche loss process of the remaining electrons begins which rapidly leads to the establishment of a negative-ion/positive-ion plasma. During the afterglow period, a progressive collapse of the wall potential and the ambipolar field occurs from those characteristic of an electron-dominated plasma to those of a negative-ion-dominated plasma. The sudden appearance of negative ion wall current is closely correlated with the avalanche collapse of the ambipolar field. The significance of these observations to mass-spectrometric sampling from afterglow plasma is discussed. (auth)

10918 TRANSITION RADIATION AT GENERATION OF LONGITUDINAL WAVES IN PLASMA. Amatuni, A. Ts.; Sekhposyan, E. V.; Elbakyan, S. S. (Erevan Inst. of Physics). Izv. Akad. Nauk SSR, Ser. Fiz.; 9: No. 1, 24-29(1974). (In Russian).

The energy dependence of relativistic particle, the angular and spectral distributions of transition radiation emitted on plasma boundary at the generation of slowly damping longitudinal waves in the region of spatial dispersion are analyzed. The effect of zeros and branch points of the dielectric permittivity in the region of strong spatial dispersion is estimated. (auth)

10919 RESONANCE STUDY OF A HIGH FREQUENCY DISCHARGE IN HYDROGEN SUBMITTED TO A STATIC MAGNETIC FIELD. Grolleau, B. (Nantes Univ., France). Rev. Phys. Appl.; 9: No. 2, 483-495(Mar 1974). (In French).

An experimental study was made of a resonance phenomenon which occurs in the plasma column of an inductively coupled rf discharge in hydrogen when submitted to a transverse static magnetic field. The parameters which govern this resonance phenomenon were investigated. It is shown experimentally that the gas pressure, the amplitude of the induced electromagnetic field, and the angle between the direction of the static magnetic field and the discharge axis are the most important parameters. (FR)

10920 INTERACTION BETWEEN A PLASMA JET AND A CHEMICALLY ACTIVE IONIZED GAS TARGET. Ivanov, A. A.; Parail, V. V. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 94-101(Jul 1974). (In Russian).

The linear stage of instability development occurring on interaction between an ion beam and a chemically active, weakly ionized target is investigated theoretically. It is shown that allowance for inhomogeneity of beam density leads to the appearance of a build-up threshold which depends on the chemical reaction cross sections and magnitude of charge exchange. This circumstance can be exploited for measuring the cross sections as a function of beam velocity. (auth)

10921 ANOMALOUS INTERACTION OF INTENSE LASER RADIATION WITH A DENSE PLASMA. Basov, N. G.; Krokhin, O. N.; Pustovalov, V. V.; Rupasov, A. A.; Silin, V. P.; Sklizkov, G. V.; Tikhonchuk, V. T.; Shikanov, A. S. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 118-133 (Jul 1974). (In Russian).

Results are presented of an experimental and theoretical investigation of the interaction of 2×10^{12} to 2×10^{13} W/cm^2 light beams from a neodymium laser with aluminium and polyethylene targets. Three effects are investigated: almost total absorption of light by the laser plasma, time oscillations of the intensity of the weak reflected signal and generating of laser radiation harmonics by the plasma. It is shown that the light beams employed, which exceed the threshold values, are required, according to the theory of parametric resonance, for development of parametric instabilities in the laser plasma. The phenomena observed are interpreted from the standpoint of the theory of parametric resonance in a plasma; in particular the concepts of parametric turbulence theory are used. The importance of measuring the period and modulation depth of the intensity of light reflected by the plasma for diagnostics of laser plasma is noted. (auth)

Plasma Kinetics (Experimental)

10922 (LA-UR-74-1549) PLASMA EXPERIMENTS IN THE SCYLLAC TOROIDAL THETA PINCH. Cantrell, E. L.; Ellis, W. R.; Harris, H. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 10p. (CONF-741105-37; IAEA-CN-33/E1-2). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Experiments are reported on plasma equilibrium and stability in the Scyllac full torus, and in earlier 5-m and 8-m toroidal sectors. In all of these experiments the outward toroidal drift was compensated by a combination of l = 1 helical and l = 0 bumpy fields generated by shaping the inner surface of the compression coil or by driven l = 1 windings. Time resolved measurements of the gross plasma column motion, plasma radius, excluded flux, external magnetic field, plasma density, electron and ion temperatures, and plasma beta have been made. Preliminary results show that the plasma behavior in the 8-m sector and the full torus (both with major radius R = 4 m), is qualitatively the same, with a well-defined, theta-pinch type plasma column being formed in both cases. No plasma shredding or evidence of microinstabilities is seen, and no $m \geq 2$ modes have been observed. The plasma confinement lasts typically 6–10 μs, and is terminated by a long-wavelength, m = 1 type motion which carries the plasma column to the wall with an effective growth rate of $0.5-1.0 \times 10^6$ s^{-1}. Photographs from a 360° framing camera mounted on the torus axis show this motion to consist of at least n = 0, 1, and 2, where m and n describe motions of the form exp $i(m\theta - nz/R)$. A net toroidal current of 1–1.5 kA flowing opposite to B_θ has been measured; this current appears to be too small to account for the experimental growth rate in terms of the current-driven Kruskal–Shafranov mode. (auth)

10923 ON-LINE CORRELATION MEASUREMENT IN A PLASMA. Ogata, A.; Matsuura, K. (Nagoya Univ., Japan). Rev. Sci. Instrum.; 45: No. 9, 1077-1081(Sep 1974).

An on-line system to measure correlation functions in a plasma is described. By combining a fast buffer memory and a digital computer, the system can analyze signals with up to 4 MHz bandwidth and has direct applications to pulsed plasmas. Hardware and software for the system are described together with a few applications. (auth)

10924 INTERACTIONS BETWEEN TWO COLLIDING LASER PRODUCED PLASMAS. Rumsby, P. T.; Paul, J. W. M.; Masoud, M. M. (UKAEA Research Group, Abingdon, Eng.). Plasma Phys.; 16: No. 10, 969-975(Oct 1974).

Two types of interaction between two adjacent expanding plasmas, produced by laser irradiation were observed. The density and temperature of both the initial and interacting plasmas were measured, by photon scattering. For interaction early in the expansion the results can be explained by classical ion-ion colli-

sions, while for later interaction (lower density) electron-electron and electron-ion collisions provide an explanation. (auth)

10925 LOW β INTERACTION OF A PURELY IONIC H^+, H^- PLASMA BEAM WITH A TRANSVERSE MAGNETIC BARRIER IN THE VICINTIY OF THE CRITICAL FIELD. Baribaud, M.; Dolique, J. M.; Monte, J.; Zadworny, F. (CNRS, Grenoble, France). Plasma Phys.; 16: No. 9, 865-881(Sep 1974). (In French).

The low β interaction with a transverse magnetic field, of a moving purely ionic H^+, H^- plasma, for $\kappa = (\omega_p/\omega_c)^2 = (^1/_2)$ $nmc^2/(B^2/2\mu_0) \simeq 1$, that is in the vicinity of $\omega_p = \omega_c$ which, for a cold ordinary plasma of unlimited extent in the transverse direction, defines the critical magnetic field above which the plasma no more penetrates the magnetic barrier, is studied. Owing to the opposite signs of q/m for the two ion species, the interaction has (v_0, B) as a plane of symmetry, where v_0 is the initial plasma velocity. Therefore, one avoids the unsymmetrical peeling-off effect of the external electrons which, in the ordinary ion-electron transversally limited plasma beams, perturbs the phenomenon for $\kappa \simeq 1$ sufficiently to prevent experimental study. Owing to the simplifying symmetry pointed out above, it was possible to study the vicinity $\kappa \simeq 1$ of the critical field and what had also not been done, the influence of the profile and of the magnetic width barrier. Severe restrictions however are imposed by the very low density $\sim 10^{13} m^{-3}$ which can be reached for the H^+, H^- plasma in the region of interaction, in spite of the high intensity of 4 mA of the H^- ion source used. (auth)

10926 HOT-ION DISTRIBUTION FUNCTION IN THE OAK RIDGE TOKAMAK. Sigmar, D.J.; Clarke, J.F.; Neidigh, R.V.; Vander Sluis, K.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. Lett. 33: No. 23, 1376-1379 (2 Dec 1974).

Observed Doppler shifts of neutral-hydrogen H_α radiation in the poloidal and toroidal directions in the Oak Ridge tokamak experiment are shown to be consistent with neoclassical theory. The inferred shift and distortion of the proton distribution function in the banana-plateau regime is caused by the radial pressure gradient and by the ambipolar electric field, whose steady-state value is determined by nonambipolar diffusion due to charge exchange. (auth)

10927 ELECTRON BEAM-PLASMA INTERACTIONS INCLUDING ION DYNAMICS. Quon, B. H. Los Angeles; Univ. of California (1974). 75p. University Microfilms Order No. 74-24,611.

Thesis (Ph. D.).

Unstable ion waves excited both by a linear micro-instability and by parametric instabilities are investigated with a large, unmagnetized electron beam-plasma system. In the case of an electron-ion drift instability, the spatial growth of a small amplitude test wave develops into a large amplitude steady state which is found to be a Bernstein-Greene-Kruskal-like ion mode with trapped electrons. Ion waves excited by large amplitude electron plasma waves via back-scattering decay processes are found to be convectively and absolutely unstable. In a strong electron beam-plasma interaction purely growing ion modes are observed when the high frequency unstable waves exceed the theoretical threshold. The measured sharp spikes in the wave amplitude indicate that the spatial localization of the high frequency field occur when the plasma is driven strongly. The spatial evolution of the electron beam-plasma system is greatly altered by the presence of large amplitude ion waves. The experimentally observed trapping of electrons in the positive potential well of the ion acoustic wave may saturate the ion acoustic instability caused by a slow electron drift. For fast electron beams the ion waves interact with the high frequency unstable waves to generate nonresonant short wavelength electron modes which are found to be efficient in accelerating electrons and thermalizing the beam. Thus, a description of the nonlinear processes and the mechanism of the beam thermalization observed in the present experiments requires the inclusion of ion dynamics. (Diss. Abstr. Int., B)

10928 ENERGY LOSS OF A LOW-ENERGY ION BEAM IN PASSAGE THROUGH AN EQUILIBRIUM CESIUM PLASMA. Cox, D. M.; Brown, H. H. Jr.; Klavan, I.; Bederson, B. (New York Univ., NY). Phys. Rev., A; 10: No. 4, 1409-1424(Oct 1974).

The energy loss of a beam of cesium or lithium ions traversing a near-thermal equilibrium cesium plasma was measured as a function of plasma density at ion-beam energies of 35 to 150 eV. The plasma electron-ion temperature ranged from 2100 to 2500°K. and the charged-particle density ranged from $(0.1 \text{ to } 8.0) \times 10^{11}$ cm^{-3}. The measured energy loss is found to agree well with theoretical predictions. (auth)

10929 TRANSPORT PROPERTIES OF A WEAKLY IONIZED CESIUM PLASMA. Cox, D.M.; Brown, H.H. Jr.; Schumann, L.; Murray, F.; Bederson, B. (Department of Physics, New York University, New York, New York 10003). Phys. Rev. A 10: No. 5, 1711-1720 (Nov 1974).

The transverse component (σ_T) of the tensor electric conductivity of a weakly ionized magnetized plasma has been measured under near-thermal equilibrium conditions. Care has been taken to minimize the effects of $\vec{E} \times \vec{B}$ drifts and finite apparatus size. For magnetic fields that are large enough, it is found that the magnetic field dependence of σ_T is $1/B^2$, in agreement with theory. It is also found that the overall density dependence of σ_T agrees with standard conductivity theory. At the highest values of the magnetic field used, the data show some deviation from theoretical predictions which include only electron transport. This deviation is attributed to ion transport, and opens up the possibility of measuring transport properties of the ions alone. (auth)

10930 INJECTION OF A RELATIVISTIC ELECTRON BEAM INTO A PLASMA. Klok, O. D.; Krementsov, V. I.; Strelkov, P. S.; Shkvarunets, A. G. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 4, 1401-1409(Oct 1974). (In Russian).

Injection of a relativistic electron beam (W = 400 keV, I = 600 A, T = 30 nsec) into a plasma is investigated. It is shown that a return current arises in the plasma which compensates the beam current. A dependence of the degree of compensation of the beam current on plasma density is obtained. A disruption of the return current in the plasma is observed. The return current first stops at the distant end of the system and then at the near end. Return-current disruption is probably connected with limited emission at the metal-plasma boundary. Under conditions when the plasma density is insufficient for total compensation of the beam current, the beam is observed to rotate with respect to the plasma axis, providing the beam and plasma axes do not coincide. (auth)

Plasma Kinetics (Theoretical)

Refer also to abstracts 10926 and 13037.

10931 (AD-759742) DRIFT, DEFORMATION, AND DIFFUSION OF A PLASMA IN A MAGNETIC FIELD. Monroe, R. (Riverside Research Inst., New York (USA)). 1 Jul 1972. Contract F19628-71-C-0162. 32p. (RRI-T-54/174-4-50). NTIS $3.00.

The theoretical problem of a weakly ionized, constant temperature, three particle plasma in an externally generated magnetic field is reformulated by transforming the set of 14 macroscopic plasma equations (continuity and momentum equations for ions and electrons plus Maxwell's equations) in 14 unknowns (ion and electron number densities and velocities plus the effective electric and magnetic fields) into an equivalent set of four integral equations in four unknowns. In the course of this transformation, it is shown that plasma behavior can be interpreted in terms of three ambipolar processes: drift, deformation, and diffusion. (NTIS)

10932 (AD-781824) STUDY OF EQUATIONS OF STATE/OPACITY OF IONIZED GASES. Final Report, 31 October 1971-21 October 1972. Cohen, H.; Vik, R.; Katz, I.; Harvey, J. (Systems, Science and Software, La Jolla, Calif. (USA)). Contract DNA001-72-C-0073. 153p. (SSS-R-72-1396; DNA-3061F-1). NTIS $5.00.

Modifications were made to the CAPO code for calculating the equation of state and opacities of plasmas. CAPO results were used to calculate emission properties of a laser heated magnetically contained plasma. A new program, DANA, was written which calculates the group average opacities of CAPO output. (auth)

10933 (COO-2059-38) THREE-DIMENSIONAL GUIDING-CENTER PLASMAS. Knorr, G. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). May 1974. Contract AT(11-1)-2059. 33p. Dep. NTIS $4.75.

A three-dimensional guiding center plasma model is derived from the Vlasov equation using a method by Frieman et al. In two dimensions the reduction of the description to configuration space occurs only for homogeneous magnetic fields. Macroscopic equations are derived for a homogeneous magnetic field and the stability of nonneutral plasmas is investigated. Sheets consisting of magnetic field lines and charged positively show unstable behavior if $k_\parallel/k_\perp < a/c_s$ where a is the $E \times B$ drift and c_s is the ion sound velocity. $k_\parallel$ and $k_\perp$ are the wave numbers parallel and perpendicular to the magnetic field. Sheets with electron charges are stable if the phase velocity of the disturbance along B is smaller than the electron thermal velocity. (auth)

10934 (COO-2456-1) COMPUTATIONAL MAGNETOHYDRODYNAMICS OF TIME-DEPENDENT FLOWS IN TOROIDAL SYSTEMS. Lui, H. C.; Chu, C. K. (Columbia Univ., New York (USA)). 1974. 6p. (CONF-740680-1). Dep. NTIS $4.00.

From 4th international conference on numerical methods in fluid dynamics; Boulder, Colorado, USA (24 Jun 1974).

The plasma is represented by a single fluid with finite electrical and thermal conductivities, but no viscosity and no particle-kinetic effects (no waves, turbulence, or trapping). The motion was studied in the poloidal plane (R-z or r-θ plane), and there is no variation in the ignorable toroidal (φ) direction. A plasma initially at rest and at relatively low temperature is driven by two prescribed functions of time: the current in the toroidal windings $I_c(t)$, and the total flux enclosed by the torus $\Psi(t)$. Currents and magnetic fields are then induced in the plasma, and the plasma moves. Naturally, all the currents, magnetic fields and velocities are three-dimensional vectors. This study gives the gross motion of the plasma in the poloidal plane, complete with pinching, bouncing, and toroidal column shift. (auth)

10935 (ORO-4627-1) PENETRATION OF MAGNETIC FIELDS INTO PLASMAS. Progress Report. Bengtson, R. D. (Texas Univ., Austin (USA). Dept. of Physics). 1973. 19p. Dep. NTIS $4.00.

An experimental and theoretical investigation of the phenomena of magnetic field penetration into a turbulent plasma has been underway. Experimental and theoretical results have been compared with theoretical scaling features in agreement with the experimental results. Details of the experimental penetration are not in agreement with theory. The effect of neutral collisions was studied and it was found that they are not important under these operating conditions but can become important with an increase in pressure. A method was developed for analyzing data to arrive at quantities such as collision frequency which can be directly compared with theories. (auth)

10936 (UCRL-51699) COMPTON COOLING OF ELECTRONS BY PHOTONS: DEPENDENCE ON THE PHOTON ENERGY SPECTRUM. Kidder, R. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Nov 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

The rate (per electron) at which a Maxwellian distribution of electrons with a temperature (T_e) loses energy via Compton scattering to a Planckian distribution of photons with an energy density (u) can be written: $\dot{E} = 4(\sigma_0/mc)u[kT_e - k(u/a)^k]$ where (σ_0) is the classical Thompson scattering cross section and (a) is the Stefan-Boltzmann constant. The corresponding rate is calculated for (non-Planckian) photon spectra associated with a uniform fully ionized isothermal gas sphere in local thermodynamic equilibrium. It is found that the formula quoted above overestimates the cooling rate if scattering is significant and absorption is negligible, underestimates the cooling rate if the converse is true, and is approximately correct if both scattering and absorption are negligible. The photon spectrum that maximizes the cooling rate is also determined. (auth)

10937 PAIR CORRELATION FUNCTION FOR A SYSTEM WITH VELOCITY-DEPENDENT INTERACTIONS. Turski, L. A. (Carnegie-Mellon Univ., Pittsburgh). J. Statist. Phys.; 11: No. 1, 1-16(Jul 1974).

The canonical statistical sum for the Breit–Darwin plasma was investigated by means of a generalized van Kampen cellular method. In particular, the pair correlation function is derived. This function agrees with that previously obtained by Trubnikov from the approximate closure of the BBGKY hierarchy. The method developed can be used for the description of other systems in which the velocity-dependent forces are pairwise. (auth)

10938 NUMERICAL SIMULATION OF A RADIALLY INHOMOGENEOUS CYLINDRICAL PLASMA. Hewett, D. W. (Univ. of Kansas, Lawrence). J. Comput. Phys.; 16: No. 1, 49-65(1 Sep 1974).

The numerical time integration of an initial value problem based upon the nonlinear Vlasov equation as applied to an axisymmetric, inhomogeneous plasma column was developed. All six components of the electric and magnetic fields are advanced self-consistently in time. An assumption was made which neglects purely electromagnetic modes. Each field contains a contribution from plasma source terms calculated by a Green's function technique as well as a boundary value contribution which may be time dependent. The Vlasov equation has been reduced to a convenient numerical form by an extension of the standard Fourier–Hermite expansion. Radial dependence is discretized. Results are presented on the streaming instability of the electrostatic column. (auth)

10939 DUPREE'S THEORY OF STRONG PLASMA TURBULENCE. Cook, I.; Sanderson, A. D. (UKAEA Research Group, Abingdon, Eng.). Plasma Phys.; 16: No. 10, 977-981(Oct 1974).

It is argued that Dupree's (Dupree T. H. (1966) Physics Fluids 9, 1773, Dupree T. H. (1967) Physics Fluids 10, 1049) diffusion theory of random acceleration in turbulent plasmas is valid only in the same parameter range as is the "classical" theory. (auth)

10940 COMPLETE INTEGRABILITY AND STOCHASTIZATION OF DISCRETE DYNAMIC SYSTEMS. Manakov, S. V. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 2, 543-555(Aug 1974). (In Russian).

A particle system with exponential interaction between the particles (Toda chain) and an equation set describing stimulated scattering of plasma oscillations by ions were investigated by the inverse scattering problem technique. Complete integrability of a Toda chain containing an arbitrary number of particles is proven. An integration scheme for the systems considered was developed and interaction between solitons was investigated. Some classes of completely integrable discrete systems, i. e., systems for which stochastization is impossible, are mentioned. (auth)

10941 ELECTRON-ION EQUILIBRATION IN A PARTIALLY DEGENERATE PLASMA. Brysk, H. (KMS Fusion, Inc., Ann Arbor, MI). Plasma Phys.; 16: No. 10, 927-932(Oct 1974).

Expressions are derived for the energy loss rate of a fast ion to electrons as it slows down in a plasma of arbitrary electron degeneracy and for the equilibration of the ions and electrons in the plasma. (auth)

10942 TWO-DIMENSIONAL PLASMA EQUILIBRIUM IN A MAGNETIC FIELD. Wong, K. L. (Univ. of Wisconsin, Madison). Plasma Phys.; 16: No. 9, 883-886(Sep 1974).

A criterion for two-dimensional plasma equilibrium is derived from the Vlasov equation. It may be shown that particle densities are constant on any surface of constant electrostatic potential only if the plasma drift kinetic energies are constant on the electrostatic equipotential surfaces. (auth)

10943 RELATIVISTIC QUANTUM THEORY FOR PROCESSES IN COLLISIONLESS PLASMAS. Melrose, D. B. (Australian National Univ., Canberra). Plasma Phys.; 16: No. 9, 845-864 (Sep 1974).

A relativistic quantum theory for processes in a plasma is developed in such a way that the theory reduces to that for a classical collisionless plasma in the classical limit and to conventional quantum electrodynamics in vacuo. The generalization involves two stages. The first stage is the use of quantum electrodynamics to calculate the linear and nonlinear responses of an electron gas. Explicit expressions are derived for the linear response of an electron gas in the absence of a static magnetic field, and for the lowest order nonlinear response of an electron gas in the absence of a static magnetic field. The second stage involves a generalization of the conventional diagrammatic technique to include the effects of the nonlinear responses of the medium. Additional diagrammatic structures called multiple-photon vertices are introduced. Rules are given for drawing the generalized diagrams and for writing down the associated amplitudes. The Cherenkov effect, photon splitting, and emission in the presence of a static magnetic field are treated as illustrative examples. (auth)

10944 QUASILINEAR THEORY OF THE LOSS OF ISOTROPY IN A PLASMA WITH SUPRATHERMAL PARTICLES. Marquis, E.; Teichmann, J. (Univ. of Montreal). Can. J. Phys.; 52: No. 20, 2014-2023(15 Oct 1974).

A magnetoplasma with isotropic distribution of particle velocities is unstable against the electron cyclotron modes, excited by the presence of a population of suprathermal electrons. The nonlinear interaction of these waves with resonant suprathermal electrons, whose initial velocity distribution was isotropic, causes diffusion in the velocity space. The distribution of suprathermal electrons becomes anisotropic. This may under certain conditions lead to new instabilities driven by the anisotropy in the velocity space. The temporal evolution of the "plateau" and the characteristic relaxation time of the quasilinear interaction was analyzed. (auth)

10945 ELECTRON TRAPPING IN A GROWING ELECTROSTATIC WAVE. Hobbs, W.E. Jr.; DeGroot, J.S. (Department of Applied Science, University of California, Davis, California 95616). Phys. Fluids 17: No. 11, 2140-2141 (Nov 1974).

The orbits of a distribution of electrons, initially cold and uniformly distributed in space, driven by an exponentially growing electrostatic wave, have been followed numerically. It is found that the average field at trapping is characterized by $\omega_B/\omega \simeq \pi/4$ ($\omega^2_B = ekE/m$) for growth rates $\gamma/\omega \leq 1/4$. (auth)

10946 ION ACCELERATION IN A PLASMA FOCUS. Gary, S.P. (Physics Department, College of William and Mary, Williamsburg, Virginia 23185). Phys. Fluids 17: No. 11, 2135-2137 (Nov 1974).

The electric and magnetic fields associated with anomalous diffusion to the axis of a linear plasma discharge are used to compute representative ion trajectories. Substantial axial acceleration of the ions is demonstrated. (auth)

10947 MODIFIED KADOMTSEV SPECTRUM FROM RENORMALIZED PLASMA TURBULENCE THEORY. Choi, D. (Center for Statistical Mechanics and Thermodynamics, Department of Physics, The University of Texas at Austin, Austin, Texas 78712); Horton, W. Jr. Phys. Fluids 17: No. 11, 2048-2060 (Nov 1974).

From the collisionless Vlasov–Poisson equations the renormalization of plasma turbulence is derived by a selective summing of secular terms to all orders in perturbation theory. The resulting renormalized theory agrees with earlier renormalizations of quasilinear theory and the mode coupling equation exhibits the same symmetries known in weak turbulence theory. The present formulation differs from that of Rudakov and Tsytovich by containing a separation of the turbulent k scales and by the associated feature of retaining the form of induced wave scattering in the nonresonant mode coupling terms. The theory is applied to the problem of finding the stationary spectrum for current driven ion–acoustic turbulence. Balancing the induced wave scattering off screened ions with a quasilinear growth rate, a modified Kadomtsev spectrum having a low $k\lambda_D$ cut off is obtained self–consistently within the collisionless theory. The turbulent energy density and effective collision frequency are computed from the new spectrum. (auth)

10948 COMPUTER SIMULATION OF PULSE TRAPPING AND PULSE STACKING OF RELATIVISTIC ELECTRON LAYERS IN ASTRON. Byers, J.A.; Holdren, J.P.; Killeen, J.; Langdon, A.B.; Mirin, A.A.; Rensink, M.E.; Tull, C.G. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Fluids 17: No. 11, 2061-2080 (Nov 1974).

During the past two years computer simulation has been used extensively to obtain a detailed description of pulse trapping and pulse stacking of relativistic E layers in astron. Resistors are essential to good trapping, in agreement with experiment. In the code, pulse trapping can easily be arranged to be 100% efficient—in marked contrast to the experiment. Details of pulse stacking are dependent on resistor configuration, degree of charge neutralization, and external well shape, but the field reversal increase invariably runs into a saturation due to axial expansion of the layer. This process can be described as a phase space exclusion or, alternatively, as nonadiabatic axial heating. The pulse–stacking process involves a tearing and bunching, and it is also nonadiabatic in the radial motion; as a consequence, radial expansion always occurs, and this can also act as a limitation to field reversal unless the resistor locations allow considerable radial room. Very tightly focused (axially) pulses can result from vacuum pulse trapping if system conditions are optimized correctly. This in turn lessens the axial expansion problem for vacuum layers. In contrast, the radial expansion problem is much more severe for vacuum layers, and this effect causes radial loss at some layer strength well short of field reversal. Large–current (2500 A) neutralized pulses result in field reversal with one pulse. (auth)

10949 COLLISIONAL PARAMETERS OF A TEST PARTICLE AND A STREAMING PLASMA. Siambis, J.G.; Stitzer, S.N. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Fluids 17: No. 12, 2192-2200 (Dec 1974).

The collisional interaction of a test–charged particle with a streaming Maxwellian distribution of field particles is considered analytically. Values are found for the collisional parameters of dynamical friction force, diffusion tensor, and rate of energy change for a wide range of field particle densities, temperatures, and streaming velocities. Retention of the velocity dependence of the Coulomb logarithm leads to substantial differences in the values of the parallel component of the diffusion tensor and the rate of energy change for the test particle as compared with the Spitzer values. Collision frequencies for momentum transfer, $\pi/2$ angular deflection, and energy change for the test particle and the test plasma are defined, simply related to each other, compared with the Spitzer definitions and evaluated for a simple case. The new definitions for the collision frequencies place in evidence the enhancement of collisional momentum and energy transfer in the absence of stationary thermal equilibrium. (auth)

10950 MAGNETIC FIELD DEPENDENCE OF PLASMA RELAXATION TIMES. Montgomery, D. (Department of Physics and Astronomy, Hunter College of the City University of New York, New York, New York 10021); Joyce, G.; Turner, L. Phys. Fluids 17: No. 12, 2201-2204 (Dec 1974).

A previously derived Fokker–Planck collision integral for an electron plasma in a dc magnetic field is examined in the limit in which the Debye length is greater than the thermal gyroradius, which is in turn greater than the mean distance of closest approach. It is demonstrated that the collision integral can be satisfactorily approximated by the classical Landau value (which ignores the presence of a dc magnetic field) if the following replacement is made: In the Coulomb logarithm, the Debye length is replaced by the gyroradius. This induces a fundamental logarithmic dependence on magnetic field in the relaxation times. Numerical comparison of the asymptotic approximations with the previously derived exact results is made, and good agreement is found. The simplification this introduces into the description of collision processes in magnetized plasmas is considerable. (auth)

10951 KINETIC THEORY OF PLASMA SCRAPE–OFF IN A DIVERTOR TOKAMAK. Hinton, F.L.; Hazeltine, R.D. (Fusion Research Center, University of Texas at Austin, Austin, Texas 78712). Phys. Fluids 17: No. 12, 2236-2240 (Dec 1974).

The structure of the plasma boundary, in a tokamak with a poloidal divertor, is considered. The assumption, of hot, collisionless ions, and cold, collisional electrons is shown to be self–consistent. The density gradient length is shown to be of the order of ρ_{pi}, the ion poloidal gyroradius, at typical poloidal angles. Plasma diffusion across the separatrix, and particle motion along the field lines to the collector plates, are described by a kinetic equation. From the solution of the boundary–layer problem, the ion flux and ion energy flux, to the plates, are calculated. The ratio of these fluxes, and the corresponding ratio for the electrons, complete the specification of divertor boundary conditions, to be used in tokamak transport codes. (auth)

10952 PROBABILITY DISTRIBUTION FOR FOURIER COMPONENTS OF THE ELECTRIC FIELD IN WEAK PLASMA TURBULENCE THEORY. O'Neil, T.M. (University of California, San Diego, La Jolla, California 92037). Phys. Fluids 17: No. 12, 2249-2254 (Dec 1974).

Probability distributions for Fourier components of the electric field, including joint distributions for various Fourier components and multiple time distributions for the same component, are determined using the central limit theorem of probability theory and two assumptions within the spirit of weak turbulence theory. The distributions are all Gaussians or simple integrals of Gaussians. This statistical framework is applied to the special case where the turbulence is dominated by the wave–particle interaction. In this case, quantities appearing in the distributions as parameters, such as the mean and standard deviation, are determined by quasilinear theory and Dupree's recent theory of phase space granulation, or clumps. (auth)

10953 MICROSCOPIC PLASMA HAMILTONIAN. Peng, Y.M. (Institute for Plasma Research, Stanford University, Stanford, California 94305). Phys. Fluids 17: No. 12, 2296-2297 (Dec 1974).

A Hamiltonian for the microscopic plasma model is derived from the Low Lagrangian after the dual roles of the generalized variables are taken into account. The resulting Hamilton equations are shown to agree with the Euler–Lagrange equations of the Low Lagrangian. (auth)

10954 CONSTITUTIVE RELATIONS FOR A ROTATING ELECTRON PLASMA. Shiozawa, T. (Osaka Univ.). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1283-1284(Sep 1974).

The constitutive relations for small-signal electromagnetic fields propagated in a cylindrical electron plasma rotating around its axis are derived with the use of the electron-theoretical approach. A rotating electron plasma is found to be equivalent to a moving dispersive dielectric with an appropriate dielectric constant, as far as small-signal electromagnetic fields are concerned. (auth)

10955 KINETIC EQUATION OF A RELATIVISTIC PLASMA IN THE WEAK COUPLING APPROXIMATION. Balescu, R.; Paiva-Veretennicoff, I.; Brenig, L. (Univ., Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 59: No. 9, 812-841(1973).

The correlation pattern formalism is used to derive a kinetic equation for a relativistic plasma and radiation. Landau and Thomson scattering are taken into account to compute the collision operator for the homogeneous weakly coupled case. An H-theorem is proved. The corresponding linearized kinetic equation is a two dimensional matrix equation, the collision operator of which is hermitian. Its spectrum is shown to be definite negative and its collisional invariants are computed. (auth)

10956 KINETIC EQUATION FOR A PLASMA IN A HIGH RADIO FREQUENCY FIELD. Bychenkov, V. Yu.; Silin, V. P. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 134-146(Jul 1974). (In Russian).

The charged particle collision integral was obtained for a plasma located in a high radio frequency electric field with a wave frequency close to the plasma one. It is shown that the high radio frequency electric field appreciably affects the diffusion coefficient. In this case the anomalous increase of the collision integral due to interaction of the particle with ion sound was observed in a very narrow region near the threshold value of the external field strength; interaction of the fast particles with Langmuir waves may lead to a significant increase of the collision integral at a distance from the threshold. The electron diffusion coefficient of a weakly turbulent plasma with a stationary noise level of ion sound was calculated. (auth)

10957 TWO–DIMENSIONAL STABILITY OF LANGMUIR SOLITONS. Denavit, J. (Technological Institute, Northwestern University, Evanston, Illinoise 60201); Pereira, N.R.; Sudan, R.N. Phys. Rev. Lett. 33: No. 24, 1435-1438 (9 Dec 1974).

We report on the stability of plane Langmuir solitons to perturbations in the transverse direction and of cylindrically symmetric solitons to azimuthal perturbations. Two-dimensional numerical solutions of the basic equations, including the effect of finite ion inertia, show that both cases are unstable and that the collapse of annular solitons in the azimuthal direction is faster than their radial collapse. (auth)

10958 ANOMALOUS PLASMA RESISTIVITY IN A LINEAR DISCHARGE. Millar, D. D. (Univ. of Sydney). Plasma Phys.; 16: No. 11, 1003-1004(Nov 1974).

Solution of the collision modified Lorentz equation for the case of fields (O, O, E_z) and (O, B_θ, B_z), where B_θ is the inevitable consequence of the plasma current I_z, leads to the conclusion that the plasma resistivity parallel to the E-field should increase with increasing B_θ, or I_z. In this there is no anomaly. (auth)

10959 BEAM-PLASMA INTERACTION IN A LONGITUDINAL DENSITY GRADIENT. Vianna, M. L.; Bers, A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 22: No. 6, 147-158(1974).

It was shown that in the presence of a plasma density gradient in the direction of beam flow the beam-plasma interaction is convectively unstable and the entire unstable pulse propagates essentially with the beam velocity; the nonlinear regime along the beam path is reached by the steady state amplification of noise to where the oscillating beam current density amplitude equals the beam current density. (MOW)

Plasma Production

Refer also to abstracts 11021 and 11150.

10960 (AD-782092) PLASMA PRODUCTION BY BEAM-PLASMA DISCHARGE. Liu, H. (Stevens Inst. of Tech., Hoboken, N. J. (USA). Dept. of Physics). Apr 1974. 96p. (SIT-P-281; AFOSR-TR-74-0966). NTIS $4.00.

Thesis.

Plasma production by a beam-plasma discharge in magnetic field was experimentally investigated. The beam-plasma instability occurring in the axial density gradient of a beam produced plasma was measured. Under the proper conditions the waves, with ω_c, will grow and decay completely in the inhomogeneous region. The decay was found to result from Landau damping of the wave by the beam. The spatial evolution of beam thermalization along the discharge was measured. At a beam-to-plasma density ratio smaller than $1/100$, plasma production was dominated by the plasma electrons which are heated by rf fields resulting from beam-plasma interaction. The power balance of the beam-plasma interaction was studied. (auth)

10961 (AD-783855) BREAKDOWN PHENOMENA IN RARE AND IN MOLECULAR GASES USING PULSED CARBON DIOXIDE LASER RADIATION. Behrens, P. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1974. 89p. NTIS $7.50.

Thesis.

Light from an atmospheric pressure, double-discharge CO_2 laser was focused in Ar, He, N_2, H_2, and air at pressures from 0.01 to 10 atm in order to produce optical breakdown. Measurements of the transmitted laser intensity were obtained and the properties of the resulting spark were studied by means of an open face camera and spectroscopic techniques. The threshold power density was discussed. The importance of loss terms other than electron diffusion loss was discussed. Emission spectra consisted of a strong continuum superimposed with strong lines due to neutral and ionized atoms. (auth)

10962 (SAND-74-5263) RECENT PROGRESS IN ELECTRON BEAM FUSION. Toepfer, A. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 24p. (CONF-741079-1). Dep. NTIS $4.25.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

Recent research carried out at Sandia Laboratories to investigate the following is described: (1) the physics of beam focusing, (2) the efficiency of coupling of energy between the beam and the target, and (3) the design of a target which will give net energy gain for a reasonable input. Initial ideas concerning target design which have dictated the parameters of the present experiments are discussed. (auth)

10963 (SAND-74-5294) INTERACTION OF SUPERPINCHED ELECTRON BEAMS WITH HEMISHELL TARGETS. Mix, L. P.; Toepfer, A. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 14p. (CONF-741079-2). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

Experiments were designed to measure the symmetry of irradiation of a hemispherical target by a single pinched beam and to substantiate the two-beam irradiation concept. X-ray pinhole photography, holographic interferometry, and PIN diode x-ray detectors were used to monitor the target during irradiation. A peaked current density with a width of several millimeters was observed. The pinch profile appears to be stable in time. The agreement between theoretical calculations and holographic data indicates a significant fraction of the beam energy can be delivered to a small pellet. (MOW)

10964 (SAND-74-5507) SIMPLE MODEL FOR ELECTRON BEAM DRIVEN PROJECTILES. Sweeney, M. A.; Clauser, M. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 10p. (CONF-741079-3). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

A simple model is used to examine the behavior of projectiles accelerated to high velocities by relativistic electron beams. This model is of particular interest as an aid to understanding the behavior of the ablator and pusher in an e-beam fusion target experiment. The target, initially at rest at x = 0, is divided into two parts: the "ablator" and the "projectile." The ablator is treated as a plasma of initial thickness d, density ρ_a, and mass per unit area $M_a = \rho_a d$. The projectile is characterized by mass per unit area M_p and center of mass position x(t). At time t = 0, the electron beam energy is deposited instantaneously and uniformly in the ablator, producing a high pressure which accelerates the projectile. The target behavior was studied as a function of various parameters such as the ratio of projectile and ablator masses, the ablator material, and the electron beam voltage. Estimates were obtained of velocities attained by the projectile and of the efficiency of energy transfer to the projectile. (MOW)

10965 (SLA-74-5176) RELATIVISTIC ELECTRON BEAM INDUCED FUSION. Chang, J.; Clauser, M. J.; Freeman, J. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 15p. (CONF-741105-43; IAEA-CN-33/F2-2). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

An approach to pulsed fusion which employs tightly focused, high power relativistic electron beams (REB's) to spherically implode dense metal shells filled with DT gas is described. The function of the dense shell is to efficiently absorb the relativistic electrons which classically have a range in solid density DT greater than one cm. The subsequent explosion of the outer region of the shell, the "ablator," imparts an inward directed momentum to the inner portion of the shell, the "pusher," which subsequently compresses and heats the DT. In addition to compressing the fuel to high density, the pusher also serves as a tamper once the fuel is ignited, thereby increasing the energy output. Recent progress in the program which has been underway at Sandia Laboratories for two years is reviewed, and important problem areas and goals for future work are described. (MOW)

10966 (SLA-74-5214(Rev.)) LASER-PLASMA STUDIES OF SOLID PELLETS IRRADIATED WITH THE SANDIA FOUR-BEAM LASER. Powell, J. E.; Beckner, E. H.; Brannon, P. J.; Cano, G. L.; Cuderman, J. F.; Glibert, K. M.; Palmer, M. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 19p. (CONF-741105-45). Dep. NTIS $4.00.

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Experiments are under way at Sandia Laboratories in which spherical CD_2 and LiD pellets are being irradiated in a tetrahedral geometry with four beams of up to 50 J/beam from a Nd : glass laser. Pellets ranging in diameter from 50 to 200 μm were irradiated with pulses of 0.97 ns width. Of the laser output energy, ~35 to 40% is absorbed by the target. Most of this energy manifests itself in kinetic energy of the ions. X-ray spectra show simple bremsstrahlung-recombination distributions which indicate electron temperatures in the few hundred eV range. No target neutrons have been observed. CD_2 targets also have been irradiated in a background deuterium gas ranging in pressure from 0.1 to 10 torr. Neutrons are observed coming from the gas. (auth)

10967 (UCRL-75979) PLASMA DEVELOPMENT IN LOW Z LASER FUSION TARGETS. Holzrichter, J. F.; Speck, D. R.; Swain, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Oct 1974. 17p. (CONF-741079-4). Dep. NTIS $4.00.

From 16th annual meeting of the plasma physics division of the American Physical Society; Albuquerque, New Mexico, USA (28 Oct 1974).

The details of the initial plasma formation, the propagation of the plasma front through the target material, and the development of the initial low temperature plasma to the final state of ioniza-

tion in a laser fusion target is not well understood. In transparent dielectric targets, the initial plasma breakdown begins by electron avalanche ionization at energy densities of about 5 to 10 J/cm^2 ($\lambda = 1.06\ \mu$ and pulse duration $\lesssim 1$ nsec). Since typical focal areas for glass lasers are less than 10^{-4} cm^2, 5×10^{-4} J causes breakdown in these targets. These numbers lead to stringent restrictions on the temporal character of laser pulses which are designed for laser fusion research. Measurements are presented showing the temporal character of a dye-mode-locking laser oscillator over an intensity range greater than 50 db. Once breakdown occurs, the deposition of laser light in the target is severely altered as the electron density approaches $n_e \approx 10^{21}$ cm^{-3}. Time resolved steak data are shown on the spatial development of plasmas in thin dielectric targets. (auth)

10968 PLASMA GENERATING DEVICE. Ehlers, K. W.; Kunkel, W. B. (to United States Atomic Energy Commission). US Patent 3,846,668. 5 Nov 1974. Filed date 22 Feb 1973. 6p.

An improved high current plasma generating device comprised of an annular shaped anode is described. Homogeneous plasma with uniform ion current density are produced for enhancing the fueling of a thermonuclear reactor. (Official Gazette)

10969 MICROWAVE ABSORPTION PLASMA BELOW THE ELECTRON CYCLOTRON FREQUENCY. Tulle, P. A. (Univ. of Montreal). Plasma Phys.; 16: No. 10, 933-945(Oct 1974).

A plasma is created by sending an electromagnetic wave along a static magnetic field. It is efficiently sustained at frequencies just below the electron cyclotron frequency and has (approximately) the same densities and electron temperatures as in the resonance case ($10^{10} < n < 10^{13}$ cm^{-3} and $5 < T_e < 30$ eV). However, the plasma diameter can be increased up to three times the vacuum wavelength of the exciting wave. An energy balance equation shows that the reduction in the input power density is balanced by an increasing confinement time in the absorption region. In spite of the nonlinear character of the phenomenon, it can be qualitatively explained by the collisionless damping of electron cyclotron waves. (auth)

10970 LASER-COMPRESSION OF D–T WITH PRECOMPRESSION BY EXPLOSION. Kaliski, S. (Instytut Podstawowych Problemow, Warsaw). Proc. Vib. Probl.; 15: No. 1, 3-15(1974).

It is shown that, by applying the method of precompression by classical explosives, with some additional measures to make the precompression process isentropic, it is possible to obtain, with a precompression of some 15 to 25, a considerable reduction in the energy of the critical laser impulse necessary to initiate the process of thermonuclear fusion. This reduction reaches, under optimum conditions, 100%, which is of essential importance for the reduction of the power threshold, and the energy of the lasers used raises the efficiency of the entire system (the efficiency of precompression may be estimated at 20%) and reduces the costs. (IAA)

10971 LASER FUSION: ONE MILEPOST PASSED; MILLIONS MORE TO GO. Metz, W. D. Science; 186: No. 4170, 1193; 1195 (27 Dec 1974).

A brief review of the AEC and KMS laser fusion programs is given. Some of the advances in DT pellet design and laser compression are described. The prospects for energy breakeven are outlined. (MOW)

10972 THEORETICAL STUDIES OF EXPLODING WIRE AND LASER HEATED PINCH PLASMAS. Chapin, D. L. Ann Arbor, MI; Univ. of Michigan (1974). 215p. University Microfilms Order No. 74-25,171.

Thesis (Ph. D.).

A magnetohydrodynamic (MHD) model was developed to describe the dynamics of both linear z-pinch and theta-pinch plasmas, as well as dense exploding wire plasmas. The MHD model used in the study is comprised of Ohm's Law, Maxwell's equations, and the hydrodynamic equations modified to include electromagnetic terms. Separate electron and ion temperatures with both finite electrical conductivity and thermal conductivities are used. The system of equations in one-dimensional (radial), cylindrical geometry is solved numerically by a computer code. The model has been generalized to describe as well the absorption of laser light in such plasmas. Two distinct types of plasmas were studied theoretically using this MHD model. The first application was an analysis of an exploding wire plasma. The second application of the MHD model was to theoretically study laser heating of a dense plasma pinch. (Diss. Abstr. Int., B.)

10973 LASER ABSORPTION IN A DENSE LITHIUM PLASMA. DeBoo, J. C. Ann Arbor, MI; Univ. of Michigan (1973). 115p. University Microfilms Order No. 74-15,697.

Thesis (Ph. D.)

A transverse excited, atmospheric pressure (TEA) CO_2 laser was used to study absorption in an exploded lithium wire plasma. The absorption of 10.6 μm radiation was measured, as were the plasma diameter, electron density, neutral density, and temperature. The measured absorption coefficient was compared to the calculated absorption coefficient. The plasma diameter was measured with an image converter camera imaged onto the laser-plasma interaction region. An f/6.3 Jarrel-Ash spectrometer and image converter camera were used to obtain time resolved emission spectra, which yielded the plasma temperature and electron density. Typical values were 5 eV and 10^{18} cm^{-3} respectively. The neutral density was obtained by analyzing the absorption of HeNe laser radiation, and the result was compared to the neutral density obtained through particle conservation. The values obtained by both methods were typically 10^{19} cm^{-3}. The measured absorption coefficient at 10.6 μm compared well with the calculated absorption coefficient for inverse bremsstrahlung in the field of ions. The total absorption was explained in terms of this absorption mechanism. (Diss. Abstr. Int., B)

10974 LASER INTERACTION AND RELATED PLASMA PHENOMENA. Volume 3A. Third Workshop Held at Troy, New York, August 13–17, 1973. Schwarz, H. J.; Hora, H. (eds.). New York; Plenum Publishing Corporation (1974). 438p. (CONF-730836–P3A; ISBN–0-306-37143-X(Vol.3a)). $32.50.

From 3rd workshop on laser interaction and related plasma phenomena; Troy, New York, USA (13 Aug 1973).

The following papers are included: nine papers dealing with high-power lasers, five papers on medium intense laser plasma interaction, and six papers on theory of instabilities and nonlinear processes. (MOW)

10975 LASER INTERACTION AND RELATED PLASMA PHENOMENA. Volume 3B. Third Workshop Held at Troy, New York, August 13–17, 1973. Schwarz, H. J.; Hora, H. (eds.). New York; Plenum Publishing Corporation (1974). 563p. (CONF-730836–P3B; ISBN–0-306-37150-2(Vol.3b)). $32.50.

From 3rd workshop on laser interaction and related plasma phenomena; Troy, New York, USA (13 Aug 1973).

The following papers are included: eight papers on the theory of compression and energy gain from laser plasmas, ten papers on experiments concerning nuclear fusion, and six papers on laser application to high energy physics. (MOW)

10976 EXPERIMENTAL STUDY OF A PLASMA PRODUCED BY A HELICAL RADIO-FREQUENCY STRUCTURE. Van Andel, H. W. H.; Churchland, M. T.; Calabrese, G. (Univ. of Montreal). Can. J. Phys.; 52: No. 22, 2246-2249(15 Nov 1974).

A plasma produced by a helical rf structure of the Lisitano type is investigated. Measurements of electron density, electron temperature, and plasma stability are reported as a function of rf frequency and power, magnetic field strength and geometry, and neutral argon pressure. It is concluded that at moderate power (~20 W), electron cyclotron resonance is important in the power absorption process. (auth)

10977 SOFT X-RAY EMISSION FROM A LASER PLASMA IN A MAGNETIC FIELD. Volyak, T. B.; Kaitmazov, S. D.; Medvedev, A. A.; Prokhorov, A. M.; Shklovskii, E. I. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 4, 1349-1354(Oct 1974). (In Russian).

The effect of a strong magnetic field on the x-rays from a laser plasma is investigated for various laser operation regimes. The x-ray generation efficiencies are compared for the cases when the target is irradiated by giant and ultrashort laser pulses. From the dependence between the intensity and hardness of x-rays thus obtained it is concluded that a nonequilibrium electron component corresponding to a temperature exceeding the mean value is present in the plasma. (auth)

10978 HIGH-FREQUENCY FACULA PLASMATRON FOR RESEARCH IN PLASMA PHYSICS AND PLASMA CHEMISTRY. Tikhomirov, I. A.; Tikhomirov, V. V.; Solov'ev, A. A.; Fedyanin, V. Ya.; Shishkovskii, V. I.; Sergeev, V. N.; Pugovkin, M. M.; Kuz'minykh, A. I. (Tomsk Polytechnic Inst., USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 799-801(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 151-153(1974).

A metallic plasmatron of the facula type is described for performing research in the physics of a high-frequency discharge and for plasma-chemistry research. A brief consideration is given to methods for determining the parameters of a plasma, which are required for handling and optimizing plasma-chemistry processes. The engineering characteristics of the installation are presented. (auth)

Plasma Stability

Refer also to abstracts 10866 and 10890.

10979 (AD-779263) COHERENT NONLINEAR THEORY OF A CYCLOTRON INSTABILITY. Sprangle, P.; Manheimer, W. M. (Naval Research Lab., Washington, D. C. (USA)). Apr 1974. 33p. (NRL-MR-2784). NTIS $3.25.

A general nonlinear theory of coherent instabilities is presented and applied to the generation of microwaves by a relativistic beam. The instability is driven both by partial F/Partial (P perpendicular) 7 0 and the relativistic dependence on cyclotron frequency on particle energy. This dependence can cause a bunching in azimuthal angle in such a way as to cause net particle energy to decrease. The nonlinear evolution of this system is studied by writing the orbit equations for a small number of particles averaged over the fast time scale. The orbit equations are then integrated numerically. The equation for the mode amplitude is found by converting energy between waves and particles. A simple analytic theory is also presented which successfully predicts the maximum field amplitude and also the behavior of the system for times long after saturation. (auth)

10980 (AD-782060) CHARGED PARTICLE BEAM-PLASMA INTERACTIONS FOR THERMONUCLEAR POWER GENERATION. Final Report. Gruber, S. (Case Western Reserve Univ., Cleveland, Ohio (USA)). Jun 1974. 48p. (AFOSR-TR-74-1039). NTIS $3.25.

A beam-plasma instability generated by a beam with a single speed of rotation about a static magnetic field was investigated. The linear growth rates of such an instability were calculated for waves near the upper hybrid frequency of the plasma. The nonlinear saturation mechanism of this instability was examined and it was found that beam particle trapping exists and is analogous to the one dimensional case. An experimental investigation of the instability is reported on and several novel techniques for diagnostics are used. (auth)

10981 (AD-783780) LINEAR PARAMETRIC INSTABILITIES AT HIGH PUMP POWERS. Interim Report, February 1973-May 1974. Roderick, N. F. (Air Force Academy, Colo. (USA)). Jul 1974. 23p. (USAFA-TR-74-12). NTIS $3.00.

The linear parametric decay and oscillating two stream instabilities were studied at high pump power for perturbations propagating oblique to the pump field. The electrostatic Vlasov-Poisson system for a homogeneous two component plasma was solved numerically to investigate the high frequency branches of these instabilities. Results show that the maximum growth rate of the oscillating two-stream instability occurs oblique to the pump field for power levels above a critical value. (auth)

10982 (IPP-III-14) INVESTIGATIONS OF THE EQUILIBRIUM AND STABILITY BEHAVIOR OF TOKAMAK DISCHARGES IN PULSATOR I. Klueber, O. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1974. 41p. Dep. NTIS (US Sales Only) $5.25.

The Pulsator I tokamak and some important properties of the plasmas produced in this apparatus are discussed with emphasis being placed on the equilibrium and stability behavior. The experiments show two different forms of the disruptive instability, a "hard" and a "soft" type, which are clearly governed by the position of the plasma column before the onset of the instability, i.e., whether it is displaced inwards or outwards, respectively. The difference is explained in semiphenomenological terms, the explanation being supported by definitive experiments. The use of programmed vertical fields allows good long-term centering of the plasma column and hence stable, reproducible discharges with q values down to 2.3. Finally, the time development of the mean electron density is discussed. (auth)

10983 (NP-20124) STUDIES OF EXPLOSIVE INSTABILITIES IN PLASMA SYSTEMS. Technical Report No. 27. Oestberg, K. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). School of Electrical Engineering). Jan 1973. 117p. Dep. NTIS (U. S. Sales Only) $9.00.

Thesis.

The coupling coefficients for the interaction between three waves were calculated numerically for a specific physical problem. Numerical values of the physical parameters, which are realistic from an experimental point of view, were used. The dependences of the coupling coefficients on the various parameters were studied. It was noted that a high density of the electron beam implies large coupling coefficients. Temperature and collisional effects were taken into account and it was clearly demonstrated how these effects may change the coupling coefficients. The possibility of obtaining an explosive instability critically depends on the dissipative effects. Roughly speaking, the initial electric fields have to exceed a threshold value $\sim \gamma/c$, where γ is an averaged damping rate of the waves and c is an averaged coupling coefficient. In this case, the threshold value becomes very large (of the order of magnitude 10^5V/m), when the effective collision frequency ν for the plasma electrons is equal to $0.01\ \omega_{pe}$. However, there is some arbitrariness in the choice of the value of ν. For lower values of ν, there will be a corresponding decrease in the threshold value. (auth)

10984 (UCID-16637) STABILIZATION OF LOW M-NUMBER INTERCHANGE MODES IN SIMPLE MIRRORS BY AXIALLY INJECTED ELECTRONS. Baldwin, D. E.; Rowlands, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. Contract W-7405-eng-48. 11p. Dep. NTIS $4.00.

It is shown that electrons injected axially along a simple mirror machine will stabilize low m-value interchange modes. Currents required to stabilize such a machine under reactor conditions would be of order 100 amps/cm^2. (auth)

10985 DENSITY AND TEMPERATURE GRADIENT FLUTE-MODE INSTABILITIES. Abhyankar, V. G. Rochester, NY; Univ. of Rochester (1974). 109p. University Microfilms Order No. 74-22,554.

Thesis (Ph. D.).

Linear instability thresholds for flutelike ($\vec{K} \cdot \vec{B} = 0$) density and temperature gradient electrostatic instabilities in the presence of a magnetic field gradient are studied. The two-fluid FLR drift equations (with the assumption of a delta-function energy distribution) are the equations of motion (Varma model). For moderate gradients, a complete parameter space description of the stability surfaces is obtained. This is then combined with previous nonlinear calculations of the mirror flute instability, to obtain a qualitative explanation of the explosive behavior and the threshold for same. A detailed examination of the pure temperature gradient instability reveals the inadequacy of the Varma model in the short wavelength region. Two modifications are then considered. Addition of a small energy spread to the Varma Equation correctly modifies the nature of the neutral stable curve in the short wavelength region. Inclusion of inertia terms also modifies it correctly but the required parameters lie well outside the experimental range. A nonlinear analysis is then performed using the energy modified set of equations and it is shown that the modification does not appreciably change the explosive behavior. (Diss. Abstr. Int., B)

10986 INVESTIGATION OF HIGH-FREQUENCY INSTABILITY IN PLASMA WITH NONLINEAR LOW-FREQUENCY WAVE. Antipov, G. N.; Kirdyashev, K. P. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 19: No. 1, 91-96(Jan 1974).

Translated from Radiotekh. Elektron.; 19: No. 1, 129-135 (Jan 1974).

Results of experiments on excitation of high-frequency oscillations by a longitudinal low-frequency wave in plasma set up by an ionic beam are presented. The experiments were conducted in absence of conditions for direct excitation of high-frequency oscillations by the ionic beam. The high-frequency excitation is localized in the region of maximum in the spatial distribution of the wave potential. The intensity of the high-frequency oscillations predominates in the frequency region $(m_e/m_i)^{1/3}\ \omega_{pe}$ in comparison with the intensity of oscillations at the Langmuir frequencies and this indicates that instability plays an important role with respect to the motion of electrons and ions in the field of the low-frequency wave. (auth)

10987 WAVE ENHANCED TRANSPORT IN AN ARC DISCHARGE. Wheeler, G. M.; Pyle, R. V. (Univ. of California, Berkeley). Plasma Phys.; 16: No. 10, 909-919(Oct 1974).

Enhanced particle transport due to a rotational flute instability in the plasma surrounding a hollow-cathode discharge was studied. The effect of enhanced transport on the plasma density profile was measured as a function of instability amplitude by changing potentials on end-ring boundaries. "End-ring stabilization" was observed to reduce enhanced transport by two orders of magnitude by reducing the radial electric field which drives the instability. The shape of the density profile could be explained by including enhanced transport in a simple diffusion theory for a cylindrical plasma with conducting boundaries. (auth)

10988 EFFECTS OF IMPURITIES ON THE TRAPPED ION DISSIPATIVE INSTABILITY. Dobrowolny, M. (L'Aquilla Univ., Italy). Plasma Phys.; 16: No. 10, 996-999(Oct 1974).

Low frequency instabilities on trapped ions are expected on theoretical grounds to occur in the future high temperature Tokamak experiments. Instability regions, in terms of plasma parameters, have been in particular derived for the trapped ion dissipative instability. Furthermore, evaluations of anomalous particle and energy losses across the magnetic field have stressed the danger that this instability represents for good plasma confinement, leading possibly to anomalous fluxes several orders of magnitude larger than the neoclassical fluxes. It is pointed out that a very efficient stabilizing factor for the ion dissipative modes may be

naturally present in the plasma owing to its impurity content. It is concluded that, both in the next generation of Tokamak devices and in future thermonuclear experiments, even in the presence of only small concentrations of light impurities, complete stabilization of the trapped ion dissipative modes should occur. (UK)

10989 EINSTEIN RELATION FOR HEATING AND ACCELERATION DURING PARAMETRIC INSTABILITIES. Weinstock, J. (Aeronomy Laboratory, National Oceanic and Atmospheric Administration, Boulder, Colorado 80302). Phys. Fluids 17: No. 11, 2138-2139 (Nov 1974).

Two simple expressions are derived which relate the maximum and mean turbulent diffusion tensor to the anomalous dissipation rate during parametric instabilities. The results apply to conditions in which saturation is due to resonance broadening. (auth)

10990 BEAM–PLASMA INSTABILITY IN AN INHOMOGENEOUS PLASMA. Bollinger, L.D.; Carr, W.; Liu, H.; Seidl, M. (Stevens Institute of Technology, Physics Department, Hoboken, New Jersey 07030). Phys. Fluids 17: No. 11, 2142-2143 (Nov 1974).

Unstable waves ($\omega > \omega_{ce}$) are observed to be localized in the axial gradient of a beam–produced plasma. This results from an increase of phase velocity due to the gradient, which permits Landau damping by the beam. (auth)

10991 INTENSE RELATIVISTIC NONNEUTRAL E–LAYERS-EQUILIBRIUM THEORY. Davidson, R.C. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Mahajan, S.M. Phys. Fluids 17: No. 11, 2090-2099 (Nov 1974).

Equilibrium properties of intense relativistic nonneutral E layers are studied within the framework of the steady–state Vlasov–Maxwell equations. The analysis is carried out for an infinitely long E layer aligned parallel to a uniform magnetic field $B_0\hat{e}_z$, assuming that the E layer is thin (radial thickness is small in comparison with the mean radius R_0) and $\nu/\gamma_0 mc^2 \ll 1$ (ν is Budker's parameter, and $\gamma_0 mc^2$ is the electron energy). Equilibrium properties are calculated for the class of thin E–layer equilibria in which all electrons have the same canocical angular momentum P_θ, but an arbitrary distribution in energy H, i.e., $f_0(H,P_\theta) = R_0 F(H + e\tilde{\phi}) \delta(P_\theta - P_0)$, where R_0, $\tilde{\phi}_0$, and P_0 are constants. One of the most important features of the analysis is that the influence of equilibrium self–fields on the radial thickness of the E layer can be large, even though $\nu/\gamma_0 mc^2 \ll 1$ is assumed and the self–field corrections to the mean radius of the E layer are small. (auth)

10992 EFFECTS OF MAGNETIC FIELD GRADIENTS ON STRONG RELATIVISTIC ELECTRON RINGS. Meger, R.A.; Lovelace, R.V.; Woodall, D.M.; Fleischmann, H.H. (Laboratory of Plasma Studies and School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14850). Phys. Fluids 17: No. 11, 2100-2106 (Nov 1974).

Experimental investigations on the RECE–Berta device at Cornell show that weak gradients in the applied magnetic field do not influence the stability of strong relativistic electron rings for field differences across the rings of up to 0.8%. The main effect of such gradients is a radial displacement of the equilibrium position of the rings toward the low–field region of the tank. The magnitude of this displacement depends on the field gradient, and the strength and geometry of the electron ring. A theory for the displaced electron ring equilibria is presented which assumes a balance of the forces due to the external field and the image fields arising from currents in the conducting tank wall. The theory shows good quantitative agreement with the observed ring movement. From these results it appears that the final "dump" of the rings can be explained by the existence of a gradient in the basic mirror field. (auth)

10993 ABSOLUTE AND CONVECTIVE ION BEAM INSTABILITY STUDIED THROUGH GREEN'S FUNCTION. Jensen, V.O.; Michelsen, P. (Association Euratom–AEK, Danish Atomic Energy Commision, Research Establishment Risø, Roskilde, Denmark); Hsuan, H.C.S. Phys. Fluids 17: No. 12, 2208-2214 (Dec 1974).

A Vlasov plasma with a double–humped, unstable ion velocity distribution function is considered. A δ function in space is assumed as the initial perturbation and the plasma response to this perturbation is calculated, i.e., the Green's function for the problem is found. The response can be divided into two parts: a self-similar, damped part of the form $t^{-1}\, h(x/t)$, and an unstable, exponentially growing part. The conditions for absolute and convective growth of the latter are discussed. (auth)

10994 ELECTROMAGNETIC WAVEFUNCTIONS FOR PARABOLIC PLASMA DENSITY PROFILES. Baños, A. Jr.; Kelly, D.L. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Fluids 17: No. 12, 2275-2281 (Dec 1974).

The one–dimensional Helmholtz equation $w'' + k_0^2\, g(z)\, w(z) = 0$, $k_0 = 2\pi/\lambda_0$, is solved making use of an extension of Langer's method. The function $g(z)$ is restricted to the class of Epstein profiles, $g(z) = g(0) + [1 - g(0)] \tanh^2 (z/2\lambda)$, where λ is the scale length, corresponding to no turning points, a quadratic turning point at $z = 0$, or a pair of turning points, depending on whether $g(0)$ is positive, zero, or negative. This method yields uniformly valid solutions in terms of confluent hypergeometric functions. First, a solution $w_+(z)$ is obtained for $0 \ll z$ which, as $z \to \infty$, becomes the transmitted plane wave. Then, applying the method of analytic continuation, a linear combination is obtained $w_-(z) = w_i(z) + w_r(z)$ valid for $z \ll 0$ which, as $z \to -\infty$, yields the superposition of the incident and reflected plane waves. As an illustration of this method and as an application to parabolic density profiles, the mean energy density of the electric field is obtained numerically, in the vicinity of $z = 0$, when the parameter ratio $\lambda/\lambda_0 \geq 100$, and for the case of a single quadratic turning point and also for the case in which there are two neighboring turning points. With this choice of parameters, the results yield useful information on the tuning criterion for parametric excitation of the ionosphere. (auth)

10995 NEW TRAPPED–ELECTRON INSTABILITY. Coppi, B.; Rewoldt, G. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. Lett. 33: No. 22, 1329-1332 (25 Nov 1974).

We have found a new instability that is driven by a radial gradient of the electron temperature or by the electron drift in the "unfavorable" curvature of the magnetic field lines for high–temperature confined plasmas in which a fraction of the electron population is magnetically trapped. The revelant mode is standing along the magnetic field, is symmetric about the point of minimum field, and has relatively short wavelengths across the magnetic field. (auth)

10996 TURBULENT ELECTRON VISCOSITY DUE TO ELECTROSTATIC INSTABILITIES IN PLASMAS WITH LARGE CURRENT SHEARS. Lindl, J. D. Princeton, NJ; Princeton Univ. (1972). 115p. University Microfilms Order No. 74-25,966.

Thesis (Ph. D.).

A study was conducted of the linear and nonlinear evolution of dc electron velocity shear flows parallel to a large magnetic field. These shear flows are examined numerically with electrostatic particle simulation codes. A two-dimensional self-consistent electrostatic code is used to simulate shear flows in an infinite magnetic field. The infinite magnetic field is treated as a static restraint which restricts any motion across the field. A 2 1/2-dimensional code (3 velocity coordinates, 2 position coodinates) with an externally imposed magnetic field is used to simulate shear flows in a finite magnetic field. The self-consistent magnetic fields due to the plasma current are ignored. In both codes the charge density and electric fields are calculated by a multipole expansion of the charge density about nearest grid points. A linear theory, which is valid for an infinite magnetic field or for finite magnetic fields in the limit that Larmor radius corrections can be neglected, is developed for arbitrary flow profiles. Both a minimum shear and minimum drift velocity are required for instability. (Diss. Abstr. Int., B)

10997 LINEAR CONVERSION AND PARAMETRIC INSTABILITIES IN NONUNIFORM PLASMA. Kim, H. C. Los Angeles; Univ. of California (1974). 48p. University Microfilms Order No. 74-24,593.

Thesis (Ph. D.).

A new kind of parametric instability was observed in a nonuniform plasma in which a resonant rf electric field and a density cavity grow simultaneously through mutual enhancement. The threshold was observed to be virtually zero and the growth rate is linearly dependent on pump intensity, E_0^2. Ponderomotive force and wave trapping were observed to be the mechanisms which drive the instability. The effects of this instability on the linear conversion and the parametric instabilities were studied. (Diss. Abstr. Int., B)

10998 CORRELOMETER FOR INVESTIGATING THE SPATIAL DEVELOPMENT OF A PLASMA INSTABILITY. Kanaev, B. I.; Piterskii, V. V.; Yushmanov, E. E. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 784-786(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 138-140(1974).

An instrument is described for time-resolved measurement of the spatial correlation function of unstable plasma oscillations under conditions of rapid variation of the object at nonidentity of the magnitude of the signal in space. The device allows the normalized correlation coefficient to be obtained as a function of time for one-shot flow of the process. The frequency of the investigated signals can range up to 15 MHz; their magnitude at the input is ~1 mV, and the time resolution of the instrument is $\lesssim 10$ μsec. (auth)

10999 PARAMETRIC APERIODIC INSTABILITY OF INHOMOGENEOUS MAGNETOACTIVE PLASMA WITH HOT IONS. Vukovich, S. (Inst. of Physics, Belgrade); Silin, V. P. Kratk. Soobshch. Fiz.; No. 1, 7-11(1974). (In Russian).

For plasma existing in a magnetic field, the effect of the spatial inhomogeneity at the threshold of the aperiodic parametric instability was examined under the conditions that the temperature of the ions exceed that of the electrons. (tr-auth)

11000 ON THE DISSIPATION OF LANGMUIR TURBULENCE. Lashmore-Davies, C. N. (UKAEA Research Group, Abingdon. Culham Lab.). Phys. Lett., A; 49: No. 5, 375-376(7 Oct 1974).

It is shown that the modulational and oscillating two stream instabilities are equivalent and that the threshold for the modulational instability is the same as the threshold for conversion of the Langmuir wave energy into electromagnetic radiation. (auth)

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Refer also to abstracts 10857, 11090, and 11094.

11001 (AD-781114) GENERATION OF ULTRA-HIGH POWER ELECTRICAL PULSES. Final Report, 1 December 1972–30 November 1973. Birenbaum, L.; Levi, E. (Polytechnic Inst. of Brooklyn, N. Y. (USA)). May 1974. Contract F30602-73-C-0053. 86p. (RADC-TR-74-119). NTIS $4.00.

The report is a comprehensive assessment of the state-of-the-art of various energy conversion techniques involving high power electrical pulse generation. The subjects treated include rotating machines, explosive devices, superconductivity, switching, and plasma techniques, including the supercritical temperature and pressure regions. (auth)

11002 (BNWL-SA-5164) ENVIRONMENTAL CONSIDERATIONS IN ALTERNATE FUSION REACTOR BLANKETS. Johnson, A. B. Jr.; Young, J. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 8 Sep 1974. 9p. (CONF-741050-2). Dep. NTIS $4.00.

From symposium on technology related for fusion reactor systems; Miamisburg, Ohio, USA (1 Oct 1974).

The principal candidate blanket materials to breed tritium in fusion reactors are listed along with potential coolants. These include lithium/lithium, Flibe/helium, and solid blanket/helium. Tritium containment during plant operation is discussed. The strengths and weaknesses of several blanket/coolant combinations in regard to localizing tritium and minimizing corrosion product radioactivity are described. (MOW)

11003 (BNWL-SA-5165) SOME SURFACE EFFECTS OF (D, T) NEUTRONS ON CANDIDATE FUSION REACTOR MATERIALS. Harling, O. K.; Thomas, M. T.; Brozinski, R. L.; Rancitelli, L. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 5p. (CONF-741015-9). Dep. NTIS $4.00.

From 21st national symposium of the American Vacuum Society; Anaheim, California, USA (19 Oct 1974).

(D, T) neutrons were used to irradiate various metals including some refractories which are candidates for fusion reactor use. Three different types of interactions of the neutron and target could contribute to the removal of atoms from the surface: (1) direct recoil ejection of radioactive daughters from atoms that have undergone a nuclear reaction, (2) lattice dynamical chain processes produced by knock-on atoms can remove surface material, and (3) ejection of micrometer size chunks due to the neutron induced release of lattice stress. Measurements of neutron induced yields for radioactive and non-radioactive species were made and the results are presented. (auth)

11004 (CLM-R-139) EDDY CURRENT LOSS IN PULSED MAGNETIC FIELDS. Khalaf-Allah, K. (UKAEA Research Group, Abingdon. Culham Lab.). Sep 1974. 11p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

The diffusion equation governing the penetration of magnetic flux into a conductor is solved for an exponentially time varying field which is: (1) parallel to a slab of finite thickness, (2) parallel to a cylindrical conductor of rectangular cross section, (3) parallel, and (4) perpendicular to a cylindrical conductor of circular cross section. In each case expressions for the eddy currents and resulting energy dissipation in the conductor are derived. (auth)

11005 (CLM-R-140) PULSED FIELD LOSS CALCULATION FOR A CRYOGENICALLY STABILIZED COMPOSITE CONDUCTOR. Khalaf-Allah, K. (UKAEA Research Group, Abingdon. Culham Lab.). Sep 1974. 9p. Dep. NTIS (US Sales Only) $4.00. UK 50 pence.

Pulsed field losses in a possible conductor for a large Tokamak experiment are calculated. The cryogenically stabilized conductor carries 5000 A dc in a 7.5 T background field. Hysteresis and eddy current loss are calculated for an 0.5 T pulse oriented (a) parallel to the conductor length and (b) perpendicular to the conductor narrow edge. The dependence of pulsed field losses on the following parameters is discussed: (a) pulse amplitude, (b) background field, (c) rise and decay time constant of the pulsed field, and (d) superconducting filament diameter. (auth)

11006 (CONF-741040-9) USE OF HIGH POWER PARTICLE BEAMS IN FUSION RESEARCH. Schilling, G. (Oak Ridge National Lab., Tenn. (USA)). 1974. 11p. Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

Charged and neutral particle beams with energies from 1 to several hundred keV and currents from 0.1 to several hundreds of amperes, pulsed for a few msec to dc, are being used or their use planned for controlled thermonuclear fusion research. Applications include the heating and fueling of plasmas in present experimental devices toward reactor conditions, the ignition, fueling, and control of future fusion power reactors, the production of high-flux 14-MeV neutrons for reactor wall material radiation damage studies, sustaining a fusion engineering reactor device to study wall materials, and direct simulation of charged and neutral particle bombardment of reactor walls. (auth)

11007 (CONF-741040-10) USE OF HEAVY-ION ACCELERATORS IN FUSION REACTOR-RELATED RADIATION-DAMAGE STUDIES. Taylor, A.; Dobson, D. A. (Argonne National Lab., Ill. (USA)). 1974. 14p. Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

The heavy-ion accelerator has become an important tool in the study of the fundamentals of radiation damage in fission- and fusion-reactor materials. Present facilities for such studies within the Materials Science Division at Argonne National Laboratory are provided by two complementary accelerator systems. Examples of the work carried out are discussed. (auth)

11008 (IFA-FR-122-1974) CONTROL OF A THERMONUCLEAR REACTOR, THE PLASMA OF WHICH IS CONTROLLED BY NUCLEAR FISSION. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 21p. Dep. NTIS (US Sales Only) $4.25.

The working bases of a thermonuclear reactor, the plasma of which is controlled by nuclear fission are developed. The density variations of the various forms of energy involved in the thermonuclear reactor and the influence of the values of these energy densities on the reactor operation are discussed. The positive role of the impurities with a high Z in the operation of this type of reactor is discussed. The neutron multiplication factor is estimated as well as the partial life times and generation time of the neutrons. The variation manner of the multiplication factor of the neutrons is discussed, thus deducing the possibility of the control and monitoring of the reactor. (auth)

11009 (IPP-6/127) STABILITY OF BOUNDARIES OF TOKAMAKS WITH RESPECT TO RIGID DISPLACEMENTS. Rebhan, E. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1974. 33p. Dep. NTIS (US Sales Only) $4.75.

The stability of axially symmetric equilibria with respect to rigid displacements is studied by means of the energy principle. For horizontal displacements and flipping the vacuum term is neglected, thus yielding sufficient stability criteria. For vertical displacements the vacuum term is kept, thus yielding a necessary and sufficient condition. The resulting stability criteria are applied to simple algebraic equilibria and numerical results are presented. (auth)

11010 (LA-5664-MS) POTENTIAL FATIGUE PROBLEMS IN FIRST-WALL LASER-CONTROLLED FUSION REACTORS. Weertman, J. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 12p. Dep. NTIS $4.00.

An estimate is made of possible fatigue problems that are likely to be encountered in the metal first wall of laser-controlled thermonuclear (fusion) reactors (LCTRs). A review is given of different sources that produce fluctuating stresses. The largest stresses occur in the form of short wavelength, thermoelastic stress pulses that start at the inner wall and move into the interior of the metal shell. It is concluded that it is likely (as suggested by Zukas) that these short wavelength stress pulses are attenuated rapidly with distance. If they are indeed attenuated strongly, high amplitude stress pulses should not cause fatigue failure of first wall metal shells. (Other sources produce cyclic stresses that are of too low an amplitude to cause fatigue failure.) Measurements are needed of the internal friction of possible first wall materials taken under conditions of high stress amplitude, and radiation damage will indicate which materials can attenuate rapidly high amplitude, short wavelength

stress pulses and thus be resistant to fatigue failure. Experiments also are needed to determine if fatigue crack growth can be produced by 14-MeV neutron collision cascades. Whether such crack growth can occur is only a theoretical speculation at the present time. If it does occur after a year's operation first-wall material may contain a high density of millimeter length cracks. (Stresses are calculated for a spherical niobium shell of radius 2 m and thickness 1 cm. These stresses generally can be converted to the values appropriate to a niobium shell of radius R by multiplying by the factor $(R_0/R)^2$, where $R_0 = 2$ m. Since the elastic moduli of other metals considered for a first wall (molybdenum, vanadium, stainless steel) are of the same order as the modulus of niobium, the calculated stress values for niobium will be approximately correct for all these materials.) (auth)

11011 (LA-5779-MS) CALCULATION OF MAGNETIC FIELDS WITH GIVEN, NEARLY CYLINDRICAL, CONDUCTING WALLS. Miller, G. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 7p. Dep. NTIS $4.00.

It is shown how the magnetic field inside a nearly cylindrical hollow conductor can be calculated using a perturbation method. Numerical results are given for the Scyllac compression coil and a possible larger bore Scyllac coil. (auth)

11012 (LA-UR-1434) 10 kA, 300 kJ MAGNETIC ENERGY TRANSFER AND STORAGE (METS) TEST FACILITY. Swannack, C. E.; Blevins, D. J.; Harder, C. R.; Lindsay, J. D. G.; Rogers, J.D.; Weldon, D. M. (Los Alamos Scientific Lab., N.Mex . (USA)). 1974. Contract W-7405-eng-36. 5p. (CONF-740957-4). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The theta-pinch fusion test reactor proposed within the controlled thermonuclear research program at the Los Alamos Scientific Laboratory will demand that approximately 250 MJ be delivered into the plasma compression coil in one millisecond at a repetition rate of four per hour. Multiple modules of superconducting inductive storage will supply this pulsed energy. A Magnetic Energy Transfer and Storage (METS) facility has been constructed to test low-loss superconducting inductive energy storage modules, superconducting switches, and developmental high voltage circuit breakers. The storage module has been tested to 12.5 kA with 386 kJ stored energy. (auth)

11013 (LBL-3208) INTENSE-NEUTRAL-BEAM RESEARCH AND DEVELOPMENT. Baker, W. R.; Berkner, K. H.; Cooper, W. S.; Ehlers, K. W.; Kunkel, W. B.; Pyle, R. V.; Stearns, J. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 12p. (CONF-741105-34; IAEA-CN-33/D2-2). Dep. NTIS $4.00.

From fifth conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The LBL "10-ampere" source, which delivered 10-A, 20-keV, 20-msec deuterium beams into the LLL 2XII mirror experiment, has been scaled up by a factor of 5. This "50-ampere" source and its operation are discussed in some detail. It produces a 10-msec, 20-keV deuterium ion beam of approximately 75 A (1.5 MW), which is converted to energetic neutrals with about 90% efficiency in a close coupled neutralizer; 67 equivalent amperes (1.34 MW) of ions and neutrals are delivered in $\pm 2^0 \times \pm 4^0$, of which 47 A (9.94 MW) are within $\pm 1^0 \times \pm 2^0$. Some of the modifications of the original 10-A source are discussed, e.g., the use of curved grids to decrease beam divergence, the addition of vanes to reduce gas flow from the source, and staging to higher energies by adding another 7 × 7 cm electrode to give two accelerator gaps in series. Finally, progress in the computational program on the optimization of ion extractors is described. (auth)

11014 (UCRL-75835) ADVANCED CONCEPTS IN FUSION–FISSION HYBRID REACTORS. Maniscalco, J. A.; Wood, L. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Jul 1974. 40p. (CONF-741086-6). Dep. NTIS $5.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

Fusion-fission hybrid reactors are viewed as sub-critical nuclear fission reactors driven and controlled by an internal high energy neutron source, the fusion reactor. Such hybrids combine naturally the neutron-richness of fusion power sources with the power-richness of fission sources, thereby eliminating the intrinsic power poverty and neutron deficiency of these respective sections. Also eliminated in uncontrived fashions are the somewhat marginal specific tritium breeding rates of realistic fusion power reactor designs, the low specific fissile material breeding rates of conventional fast breeder fission reactors, the criticality control problems of fast breeder reactors, the (very large) demands of both fast breeder and light water reactors for both mined uranium and separative work capacity, and possible cost and technological complexity problems of fusion power reactor designs realizable in the near term. It is argued that fusion-fission hybrids may be developed on time scales adequate for deployment in power systems in the early 1980s with low technological risk, relative to pure fusion reactors, and with the elimination of most of the safety, control, long fuel increase times, and mined uranium and separative work requirements associated with fast breeder reactors. Moreover, they can at once supply very large quantities of fissile fuel to other, pure fission power reactors, and very large amounts of tritium to a commencing pure fusion energy economy, while serving as very efficient "burners" for the entire actinide inventory (uranium and thorium) of our planet, utilizing both fissile and non-fissile isotopes. Such hybrids may thus serve as a very natural link of as great a scale and of as long a duration as desired between present light water power reactors and a pure fusion power economy, augmenting the utility and useful lifetimes of the former while fostering the development of the latter. Specific examples of hybrid reactors are presented, and calculated performance parameters given for quasi-optimal designs. These calculations explore for the first time, the time-dependence of hybrid performance over a complete reactor fuel cycle. (auth)

11015 (UCRL-75919) MAGNETICALLY-DRIVEN METAL LINERS FOR PLASMA COMPRESSION. Shearer, J. W.; Condit, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Sep 1974. 43p. (CONF-741113-1). Dep. NTIS $5.25.

From international conference on energy storage, compression and switching; Turin, Italy (5 Nov 1974).

An approximate analytical model of liner compression in cylindrical geometry is formulated. The results are applied to reactor applications. The emphasis is on the imploding metal liner itself as a means of energy compression for fusion. (MOW)

11016 (UCRL-76020) INTENSE STEADY-STATE 20 kV MULTIPLE APERTURE ION SOURCE "MATS III". Osher, J. E.; Hamilton, G. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 8p. Dep. NTIS $4.00.

A multiple aperture ion source MATS III has been developed for 5 to 20 keV steady-state H^0 beam injection into the Baseball II controlled fusion experiment. The source utilizes a magnetically shaped reflex arc for plasma production over a large area. For steady-state operation each of the accelerator-decelerator set of three electrodes is designed with internal water cooling. Typical operation for a 6.4 cm diameter array of 63-4 mm diameter shaped apertures is 1.5 amp drain at 20 kv yielding a total of 0.9 amp calorimetric on a 100 cm^2 target located 250 cm from the ion source. (auth)

11017 (UCRL-76033) MEASUREMENTS OF NEUTRON EMISSION SPECTRA FROM 14-MeV NEUTRONS ON THICK TARGETS. Anderson, J. D.; Hansen, L. F.; Wong, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. 17p. (CONF-741109-1). Dep. NTIS $4.00.

From international symposium on radiation physics; Calcutta, India (30 Nov 1974).

Spherical assemblies of materials ranging from 1 to 5 mean-free-paths were bombarded with a centered 14-MeV neutron source. The emitted neutron energy spectra were measured using time-of-flight techniques (2 to 10 ns FWHM system resolution) in a geometry where the flight path (7 to 10 meters) is long compared to the dimensions of the spherical targets. It has proved possible to measure emission spectra from 14 MeV (the source energy) down to 10 keV. Two detector systems were used: a NE 213 liquid scintillator for high-energy neutron measurements ($E_n > 1$ MeV) and a ^{6}Li glass detector for the low-energy measurements (10 keV < E_n < 1 MeV). Measured spectra are presented for materials of particular interest to controlled thermonuclear reactors, e.g., ^{6}Li, ^{7}Li, C, and Fe. The examples cited are chosen to emphasize the usefulness of these bulk measurements in (1) checking transport codes, (2) evaluating neutron cross sections, and (3) assessing the reliability of computational and/or reaction models. (auth)

11018 (UCRL-76117) MIRROR SYSTEMS. Lee, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Oct 1974. 16p. (CONF-741036-1). Dep. NTIS $4.00.

From AIME-IMD symposium on materials for controlled thermonuclear reactor systems; Detroit, Michigan, USA (21 Oct 1974).

The magnetic mirror approach to fusion is introduced and the results of an experimental mirror reactor design study are presented. The major components of the mirror reactor system are described and some material questions identified. (auth)

11019 (UCRL-76143) TRITIUM PROBLEMS IN FUSION REACTOR SYSTEMS. Hickman, R. G. (California Univ., Livermore Lab.). 29 Oct 1974. 26p. (CONF-741050-1). Dep. NTIS $4.50.

From symposium on technology related for fusion reactor systems; Miamisburg, Ohio, USA (1 Oct 1974).

A brief introduction is given to the role tritium will play in the development of fusion power. The biological and worldwide environmental behavior of tritium is reviewed. The tritium problems expected in fusion power reactors are outlined. A few thoughts on tritium permeation and recent results for tritium cleanup and CT_4 accumulation are presented. Problems involving the recovery of tritium from the breeding blanket in fusion power reactors are also considered, including the possible effect of impurities in lithium blankets and the use of lithium as a regenerable getter pump. (auth)

11020 (WASH-1296) APPLICATION OF COMPUTERS TO CONTROLLED THERMONUCLEAR RESEARCH. (USAEC, Washington, D. C.). Jul 1973. 46p. Dep. NTIS $5.45.

The Ad Hoc Panel on the Application of Computers to Controlled Thermonuclear Research was created on May 18, 1973. The Panel was asked: (a) to survey and summarize the existing level-of-effort in the application of computers to CTR, (b) to identify important CTR physics and engineering questions that are or may be soluble by the use of computers, and to evaluate the benefits that would accrue to the CTR program if such solutions were obtained, and (c) to survey, summarize and evaluate the status of present and anticipated computer technology for the purpose of accurately forecasting the type, size, scope, and composition of a facility that would realize the benefits identified in (b) above, and the lead time necessary for assembling it. Conclusions of the Panel are included. (MOW)

11021 ASTRON E-LAYER EQUILIBRIA FORMED BY INJECTION. Lovelace, R.V.; Fessenden, T.J.; Sudan, R.N.; Fleischmann, H.H. (Laboratory for Plasma Studies and School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14850). Phys. Fluids 17: No. 11, 2081-2089 (Nov 1974).

A study is made of the collisionless E-layer equilibria which are formed by the injection and trapping of a relativistic electron beam in a cylindrical conducting vessel. Assuming axisymmetry, information about the general E-layer equilibria is derived from the conservation of canonical angular momentum. Of particular interest for the design of experiments is the range of radial thicknesses and the average radius of the layers as a function of layer strength ζ. Under certain conditions there is shown to be a maximum radial thickness Δr_{max}, dependent only on ζ. For a number of practical cases $\Delta r_{max}/\bar{r} \simeq \zeta^{1/2}$, where $\bar{r}$ is the average radius. The balance of axial pressures and over-all energy conservation are imposed as constraints on the general equilibria. For most of the cases studied these constraints are incompatible with the assumption of a radially thin E layer. In such cases the thin-layer equilibria are inaccessible, but it is expected that the thick-layer equilibria are accessible. (auth)

11022 OBSERVATIONS OF THE STABLE EQUILIBRIUM AND CLASSICAL DIFFUSION OF FIELD REVERSING RELATIVISTIC ELECTRON COILS. Phelps, D.A.; Smith, A.C.; Woodall, D.M.; Meger, R.A.; Fleischmann, H.H. (Laboratory of Plasma Studies and School of Applied and Engineering Physics, Cornell University, Ithaca, New York 14850). Phys. Fluids 17: No. 12, 2226-2235 (Dec 1974).

Observations of high current relativistic electron coils are presented and interpreted theoretically. Electron coil self-magnetic field strengths up to almost twice that of the external magnetic field at the mirror center are observed. Lifetimes up to 30 μ are related to the classical diffusion of electron coils in a stable equilibrium state. The diffusion mechanism is verified as inelastic small angle scattering of the relativistic electrons from a neutral gas background. (auth)

11023 THERMONUCLEAR MICRO-EXPLOSIONS WITH INTENSE ION BEAMS. Winterberg, F. (Univ. of Nevada, Reno). Nature (London); 251: No. 5470, 44-46(6 Sep 1974).

The use of intense ion beams in nuclear fusion technology is discussed. In the method suggested the ion beams are generated in a magnetically insulated diode, a pulsed laser beam being directed on to the anode surface while a high voltage is applied to the diode. A magnetic field is directed parallel to the cathode surface. The mode of operation of such a device is described in detail. Singly ionized heavy ions, such as those of Pb or U, are preferably employed. Variation of the ion velocity with voltage may be used to focus the beam by increasing the diode voltage during the pulse. The total beam power density may be increased by using a large number of diodes in spherically symmetric arrangement, the diodes having a concave shape so that each beam pulse has the form of a spherical segment. It is conceivable that by a properly chosen laser frequency a highly uniform ionization can be achieved. The range of heavy ions in dense matter is rather small, so that they can be easily stopped if projected on to a solid piece of fusionable material. The ions are projected into a long drift tube; beam energies of 100 MJ are conceivable, necessitating a 100 m drift tube. Possibilities of the proposed technique for nuclear micro-explosions are mentioned. (UK)

11024 RADIATION EFFECTS IN THE FUSION POWER PROGRAMME. Holmes-Siedle, A. (Univ. of Reading, Eng.). Nature (London); 251: No. 5472, 191-196(20 Sep 1974).

Research is needed into the problems that will arise in controlled thermonuclear reactors concerning damage likely to be caused by radiation during a reactor's lifetime. The nature of these problems is outlined and a description is given of work that is going on with regard to the extensive damage and excitation effects which would be expected to occur in the confinement system. Neutron and ionising radiation damage will be heavy, and mechanical stress and temperature levels will be high. In the discussion, data are drawn from the UK Tokamak design and the US Theta-Pinch design, which represent two divergent approaches to a power producing toroidal reactor. The reactors will involve very complex systems, including a wide variety of high performance components, such as high vacuum chambers, powerful magnets, and many other complicated systems. A timetable is suggested for the needed research, terminating with a demonstration reactor in 1982 to 1990. It is thought that the strength of metals under the irradiation may be the limiting factor in the life and efficiency of the reactors. (UK)

11025 RADIOACTIVITY INDUCED IN A THETA-PINCH FUSION REACTOR. Dudziak, D. J.; Krakowski, R. A. (Los Alamos Scientific Lab., NM). Nucl. Technol.; 25: No. 1, 32-55 (Jan 1975).

Induced radioactivity and afterheat in fusion reactor blanket structures and magnetic coils are essential inputs for environmental impact studies. These quantities have been calculated for a reference theta-pinch reactor (RTPR) and compared with results reported for other fusion reactors and typical fast fission reactors. Major independent variables considered in the RTPR analysis were structural material (Nb-1% Zr, V-20% Ti), 14.1-MeV neutron wall loading (0.2 to 6.7 MW/m^2), operating time (1 to 20 yr) and time after shutdown (0 to 30,000 yr). For a given operating time large radioactivity contributions from ^{95}Nb render higher {Ci/W(th)} and {Ci/[W(th)yr]} values at higher wall loadings and <1 yr after shutdown. At long times after shutdown this dependence is reversed and represents an advantage relative to long-term radwaste storage. Activity from V-20% Ti is insensitive to wall loading or operating time. For either material, afterheat power densities are about two orders of magnitude lower than for fission reactors. (auth)

11026 IMPROVING THERMAL INSULATION IN TOKAMAK TO-1 DURING PULED DISPLACEMENT OF PLASMA FILAMENT. Artemenkov, L. I.; Kozlov, P. I.; Melikhov, P. I.; Papkov, L. N. Sov. At. Energy (Engl. Transl.); 36: No. 3, 271-272(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 219-220(Mar 1974).

Three discharge stages were observed in Tokamak TO-1: macrounstable, "free" movement, and stage of contact with diaphragm. In the second stage, the filament is macroscopically stable, interacts weakly with the diaphragm, and is displaced towards the outside of the chamber. Meanwhile, the plasma conductivity and thermal energy, determined from the diamagnetic effect, increase. In the third stage, energy losses from the plasma increase due to contact with the diaphragm. The present paper describes experiments on improving plasma parameters by increasing the filament "free" movement time. External control of the automatic-regulating system was used for our purposes. This system consists of four independent circuits of the same type: a regulator (two-pole) and a control-winding section connected to it. (MOW)

11027 FOCUSED-FLOW MODEL OF RELATIVISTIC DIODES. Goldstein, S.A.; Davidson, R.C. (University of Maryland, College Park, Maryland 29742); Siambis, J.G.; Lee, R. Phys. Rev. Lett. 33: No. 25, 1471-1474 (16 Dec 1974).

A new model of electron flow in high-voltage diodes and superpinch formation is presented. The relativistic cold-fluid-Maxwell equations are reduced, under certain assumptions, to one equation. The model is based on the solution for the electron flow in large aspect-ratio diodes and the inclusion of cathode and anode plasmas. The anode plasma is assumed to be a field-free region. Results are compared to the parapotential-flow model. (auth)

11028 ATOMIC REACTOR-LASER. Gudzenko, L. I.; Yakovdenko, S. I. Kratk. Soobshch. Fiz.; No. 2, 14-15(1974). (In Russian).

The concept of creating an atomic reactor with a new method for the introduction of its energy with laser beams is discussed. (tr-auth)

11029 SIMILARITY LAWS IN TURBULENT FOCUS PLASMA WITH BEAM-BEAM NEUTRON PRODUCTION. Kaeppeler, H. J.; Ruhs, N. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). Phys. Lett., A; 49: No. 5, 383-385(7 Oct 1974).

The problem of scaling plasma focus devices for increased neutron output has recently been discussed by several authors. Imshennik et al. developed a similarity theory, proceeding from the assumption that the ratio of collision mean free path to character-

istic length of the device should remain constant throughout the scaling process. In the following note, it is shown that the constancy of the Mach number to Reynolds number ratio can be argued from a kinetic treatment of the neutron production mechanism. Furthermore, the influence of turbulent resistivity is considered throughout the similarity considerations, and for the current an equation yielding the dip due to collapse is employed instead of using the maximum current value. (auth)

11030 EVALUATION OF THE REACTIVITY OF THE D–T THERMONUCLEAR FUEL FOR ISOTROPIC AND ANISOTROPIC DISTRIBUTION FUNCTIONS. Nakach, R.; Werkoff, F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de la Physique du Plasma et de la Fusion Controlee). Phys. Lett., A; 49: No. 5, 386-388(7 Oct 1974).

The D–T reactivity for various distribution functions has been calculated by two methods by using the exact expression of the relative velocity of the colliding particles. An analytical representation of the cross-section and a Monte-Carlo technique are used. (auth)

11031 COMPARATIVE STUDY OF SEVERAL FUSION REACTOR BLANKET DESIGNS. Abdou, M. A.; Conn, R. W. (Univ. of Wisconsin, Madison). Nucl. Sci. Eng.; 55: No. 3, 256-266(Nov 1974).

A study of the nuclear performance of several recently reported fusion reactor blanket designs is presented. In particular, the nuclear heating, the tritium breeding ratio, and the charged-particle production rates in the various systems are reported. It is found that the total nuclear heating can be overestimated by as much as 30%, that ~20 MeV per fusion is a typical value for the energy production capability of most blankets, and that 22.4 MeV per fusion is a more maximum than nominal value for blankets without fissile materials. The tritium breeding ratio in lithium blankets is high, and uncertainties in nuclear data are unlikely to prevent such systems from breeding. Flibe blankets are marginal in this regard, and uncertainties can prevent breeding in these systems. Hydrogen and helium production rates are fairly large in all systems; they are highest in sintered aluminum product and in the PE-16 alloy, and lowest in niobium, with stainless steel in between. However, much of the required nuclear data on charged-particle-producing reactions is unavailable, and the need for cross-section measurements in this area is discussed. (auth)

11032 CALCULATIONAL METHODS FOR NUCLEAR HEATING AND NEUTRONICS AND PHOTONICS DESIGN FOR CTR BLANKETS AND SHIELDS. Abdou, M. A. E. A. Madison, WI; Univ. of Wisconsin (1973). 364 p. University Microfilms Order No. 74-8981.

Thesis (Ph. D.).

Calculation of "response" rates of interest is discussed. The general form for a response rate is $R = \int_{\vec{P}} F_R(\vec{P})\,\psi(\vec{P})\,d\vec{P}$ where $F_R(\vec{P})$ is the response function, $\psi(\vec{P})$ is the angular flux, and $\vec{P}$ represents a point in the phase space $(\vec{r},\vec{V})$. The investigation is divided into three parts: 1 - the development of models for calculating the response functions for nuclear heating, called fluence-to-kerma factors (sometimes referred to as energy deposition parameters) and other responses of interest, 2 - the accurate determination of ψ, and 3 - a study of the neutronics and photonics performance of CTR blankets and shields using the results from parts 1 and 2. (Diss. Abstr. Int., B)

11033 HEATING RATES IN BLANKETS OF FUSION REACTORS. Cochran, R. G.; Davidson, J. N. College Station, TX; Texas A and M Univ. (1974). 146p. University Microfilms Order No. 74-21,213.

Thesis (Ph. D.).

Spatially dependent neutron and gamma fluxes and their associated heating rates were calculated for two separate breeding blankets of a conceptual fusion reactor. Both designs incorporate liquid lithium as the major coolant, but one has a structure of niobium, while the second is constructed of stainless steel, with some liquid sodium cooling. Calculations involving various energy group structures and degrees of anisotropy are also made to determine the effect of these parameters on the heating rates. All calculations were made with a program system specifically developed to determine the heating rates in conceptual CTR blankets. In the program system, transport theory is used to determine the gamma and neutron fluxes. For a 10 MW/m^2 loading of incident 14 MeV neutrons on the first wall, the maximum total heating rate obtained is on the order of 108 w/cm^3 of which 100 w/cm^3 are due to gamma ray interactions. This heating rate occurs in the first wall of a conceptual blanket which uses niobium as the structural material. The first energy group neutron flux (13.5–14.9 MeV) plays a dominant role in determining the heating rates in the blanket, not only in the energy deposited by this group itself, but also in producing the high energy gamma rays (12–14 MeV) which are responsible for 67% of the energy deposited by gamma rays in the first wall of a blanket of niobium construction. (Diss. Abstr. Int., B)

Wave Phenomena

Refer also to abstracts 10875 and 12440.

11034 (AD-782257) NONLINEAR ROTARY WAVE ION PLASMA. Final Technical Report. Duane, B. H.; Liemohn, H. B. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1974. Contract N00014-73-C-0333. 50p. NTIS $3.25.

The interaction between a rotary electromagnetic plane wave propagating along an axial magnetic field and an arbitrary phase-space distribution of charged particles was solved exactly for selected cases. The interaction is described by the nonlinearly coupled Vlasov-Maxwell ion-plasma field equations which are integrated with the assistance of four new constants of the motion. The ion orbits in momentum space are bipolar double periodic eigenfunctions of ion proper time, which are obtained in closed form as the difference between two doubly quasi-periodic Weierstrass zeta functions. The ion orbits in position space are helical-spiral doubly quasi-periodic functions of ion proper time, expressible simply in the terms of doubly quasi-periodic Weierstrass sigma functions. (auth)

11035 (AD-783266) ELECTROMAGNETIC PULSES AT THE BOUNDARY OF A NONLINEAR PLASMA. Satorius, E. H. (California Inst. of Tech., Pasadena (USA). Antenna Lab.). Aug 1974. 117p. NTIS $4.50.

An investigation is presented of the behavior of strong electromagnetic pulses at the boundary of a nonlinear, cold, collisionless, and uniform plasma. The nonlinearity considered here is due to the nonlinear terms in the fluid equation which is used to describe the plasma. Two cases are studied: first considered is the case where there is a voltage pulse applied across the plane boundary of a semi-infinite, nonlinear plasma. In the second case, the reflection of incident E-polarized and H-polarized, electromagnetic pulses at various angles of incidence from a nonlinear, semi-infinite plasma is considered. (auth)

11036 (AD-784401) STIMULATED CYCLOTRON RESONANCE SCATTERING AND THE PRODUCTION OF POWERFUL SUB-MILLIMETER RADIATION. Final Report. Sprangle, P.; Granatstein, V. L. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 12p. (NRL-MR-2834). NTIS $3.00.

Interaction of a high frequency electromagnetic pump wave with a magnetized plasma is analyzed. Enhanced growth rates for parametric instability were found near cyclotron resonance. The result implies that tunable, high power, submillimeter sources could be developed using intense relativistic electron beams. (auth)

11037 (IPP-IV-76) ABSORPTION OF THE LOWER-HYBRID WAVE IN A THERMONUCLEAR PLASMA. Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1974. 18p. Dep. NTIS (U. S. Sales Only) $4.00.

Computations using the full hot-plasma dielectric tensor show that the lower-hybrid characteristics depart significantly from the analytic results of Stix and Glagolev. The discrepancy is traced to the neglect of the terms involving higher-order Bessel functions while performing the summations for obtaining the components of the dielectric tensor, leading to the breakdown of the analytical approaches in the neighborhood of the resonance. For typical thermonuclear parameters the damping term due to electron resistivity dwarfs the contribution due to Landau damping. Unlike the earlier conclusions, conversion of the lower-hybrid wave to either the acoustic or the cyclotron-harmonic modes seems neither plausible nor necessary for the purpose of energy absorption. Boundary value solutions using stepped slab model show that the penetration problem of the electromagnetic wave into the plasma is not materially affected by the inclusion of finite temperature effects. As the wave approaches the hybrid layer, the Poynting vector decreases with a corresponding increase in the energy transport due to the particle motion. This energy is, in turn, deposited into the plasma electrons through resistive absorption near the resonant layer where the group velocity becomes considerably less than the ion-thermal speed. The wave is efficiently absorbed even at the plasma temperature of 10^8°K when the ratio of collision frequency to wave frequency, $\nu/\omega \sim 10^{-7}$. (auth)

11038 (IPP-IV-77) EXCITATION OF PLASMA WAVES BY GAPS AND SLOW-WAVE STRUCTURES. Derfler, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F.R.

Germany)). Sep 1974. 48p. (CONF-740969-1). Dep. NTIS (US Sales Only) $5.25.

From symposium on plasma heating in toroidal devices; Varenna, Italy (3 Sep 1974).

Maxwell's equations are solved for a cylindrical waveguide containing a magnetoplasma with a prescribed density profile. A complete set of orthogonal azimuthal and radial modes, and their dispersion relations is obtained. Power flux and surface current are then used to define a power-equivalent rf plasma potential and a characteristic wave impedance for each mode. The result is applied to axisymmetric systems of plasma wave excitation consisting of a sequence of gaps in the waveguide, connected to appropriate circuits. The respective boundary value problems are reduced to the case of a single gap with surface currents and power equivalent plasma potentials prescribed at two locations left and right from the gap. The Green's function is obtained for that case and used to set up an integral equation for the electric field along a surface bounded by the gap. An approximate solution based on Schwinger's variational principle amounts to matching the admittances looking both ways through the gap. That gives three by three admittance matrices, one for each mode, which relate the surface currents and potentials at the prescribed locations and at the gap. (auth)

11039 (IPPCZ-172) ENERGY-MOMENTUM TENSOR FOR AN ELECTROMAGNETIC WAVE IN PLASMA. Klima, R.; Petrzilka, V. A. (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). 1972. 13p. INIS.

The energy-momentum tensor is derived for a plane quasi-monochromatic wave packet of an electromagnetic wave in a cold collisionless nonmagnetized plasma. A comparison with previous results indicates the relevance of nonlinear motion in the direction of wave propagation. (auth)

11040 (PF-2-73) DISTRIBUTION OF INTERACTION NEAR THE ION-CYCLOTRON FREQUENCY IN A BEAM-PLASMA SYSTEM. Sinman, A.; Sinman, S. (Ankara Nuklear Arastirma Merkezi (Turkey)). Nov 1973. 6p. (In Turkish). INIS.

A warm beam–plasma column was formed, using a tetrode pattern electron gun with magnetron injection; starting on the assumption that a frequency distribution could occur in the W_3 interaction in the warm ions of the plasma column and frequencies close to the ion cyclotron frequency. A study was conducted on the frequency distribution of W_3 interaction together with the first harmonic under specific test conditions. (auth)

11041 THEORY OF ABSORPTION OF ELECTROMAGNETIC OSCILLATIONS IN A PERIODICALLY NONSTATIONARY MAGNETOACTIVE PLASMA. Kireev, N. N. Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 6, 789-797(1974). (In Russian).

The elementary theory of absorption of electromagnetic oscillations by plasma in the presence of the variable magnetic field is constructed. The criterion of applicability of the linear theory to such problems is investigated. The results of the theory are applicable for explaining the character of helium ion acceleration into helium under the influence of nonstationary electric and magnetic fields. (auth)

11042 INDUCED WAVE SCATTERING IN PLASMA. Kuznetsov, E. A. (Inst. of Nuclear Physics, Novosibirsk, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 8, 1108-1115(1974). (In Russian).

A dynamic description is suggested for the Langmuir wave turbulence based on the averaging over characteristic time $1/\omega_p$ (Bogolyubov–Krylov method). It is shown that the induced wave scattering by plasma particles represents the wave scattering by low-frequency plasma density fluctuations and electron gas velocity pulsations. The stability of a Langmuir large-amplitude wave is investigated. (auth)

11043 ELECTRON CYCLOTRON WAVE RESONANCES AND POWER ABSORPTION EFFECTS IN ELECTRODELESS LOW PRESSURE hf PLASMAS WITH A SUPERIMPOSED STATIC MAGNETIC FIELD. Oechsner, H. (Univ., Wuerzburg, Ger.). Plasma Phys.; 16: No. 9, 835-844(Sep 1974).

The density of inductively exited low pressure hf plasmas was measured as a function of a small transverse static magnetic field for various levels of the hf power applied to the discharge. Evidence is given for the plasma excitation by the zero and first order electron cyclotron wave resonance. Characteristic differences between the results at low and high hf powers are discussed with a simple model of the power absorption by the plasma electrons. (auth)

11044 ION WAVES AND IONIZATION WAVES IN A PLASMA OF FINITE RADIUS. Twomey, D.; Franklin, R. N. (Oxford Univ.). J. Phys., D (London); 7: No. 14, 1963-1974(21 Sep 1974).

The equations for a cylindrical plasma column with radial variations of the discharge parameters are examined for solutions corresponding to ion waves and ionization waves. Comparison with other less complete treatments shows that allowing for such radial variations introduces no new physical processes and that the numerical corrections involved are usually less than a factor of two in the dispersion relations for such waves. (auth)

11045 TRANSFORMATION OF REGULAR WAVES ON INHOMOGENEITIES OF NON-EQUILIBRIUM PLASMA. Kalmykova, S. S. (Kharkov State Univ.). Plasma Phys.; 16: No. 10, 891-899 (Oct 1974).

The theory is developed of the transformation of electromagnetic waves on nonequilibrium plasma inhomogeneities. The components of the transformation tensors for quasi-longitudinal and quasi-transverse waves at a plasma density discontinuity in an anisotropic plasma waveguide penetrated by a monoenergetic electron beam, are calculated; in the limiting case of relatively small current and large relative jump of plasma density, analytical expressions are obtained for the tensor components; the physical processes on which such a transformation is based are explained. Using the results obtained the characteristic oscillation spectra of the plasma-beam waveguide are calculated. (auth)

11046 NON-LINEAR WAVE PROPAGATION IN A SLIGHTLY INHOMOGENEOUS PLASMA. Weibel, E. S. (Ecole Polytechnique Federale, Lausanne, Switzerland). Plasma Phys.; 16: No. 10, 921-926(Oct 1974).

A medium which may be slightly inhomogeneous in space and time is characterized by its current response. A system of equations describing the linear and non-linear coupling of WKB modes is derived. (auth)

11047 REMOVAL OF THE HEAVILY DAMPED MODE FROM THE EQUATIONS OF A PARTIALLY IONIZED PLASMA. Uncles, R. J. (Imperial Coll. of Science and Tech., London). Plasma Phys.; 16: No. 10, 947-953(Oct 1974).

The possibility of removing the heavily damped fast thermal mode from the equations describing a partially ionized plasma is discussed. This mode is removed when it is assumed that the electron density and temperature are in Saha equilibrium, although the resulting solutions are only accurate at high temperature. It is shown that the fast thermal mode can also be removed by neglecting the temperature relaxation term in the electron energy equation; and that the approximate solutions are accurate over a wide range of electron temperatures. (auth)

11048 NONLINEAR EFFECTS OF TWO MODIFIED ORDINARY MONOCHROMATIC WAVES. Selim, A. A. (Cario Univ.). J. Plasma Phys.; 12: No. 2, 287-295(Oct 1974).

Quantum field theory is used to investigate the nonlinear effects of two modified ordinary monochromatic waves propagating across a uniform magnetic field. Amplitude-dependent wavelength and frequency shifts are derived. Unlike previous work that employs the Krylov–Bogolyubov–Mitropolskii method, the investigation uses the diagrammatic technique of field theory. The calculations show that increase of the above-mentioned physical parameters due to nonlinear interaction and drifting electrons depends upon the ratio of drifting to phase velocity. (auth)

11049 PLASMA WAVES IN OSCILLATING ELECTROMAGNETIC FIELDS. Construction of the Dispersion Relation. Lerche, I. (Univ. of Chicago). Plasma Phys.; 16: No. 10, 955-967(Oct 1974).

When a plasma and time dependent electric field co-exist in a self-consistent manner it is well known that the plasma, if non-relativistic, forces the time dependence of the electric field to be sinusoidal with angular frequency equal to the plasma frequency, but of arbitrary amplitude. What happens if such a system is infinitesimally perturbed is discussed. It is demonstrated that, in general, the normal modes of the perturbed system are derivable from an infinite determinant which arises from doubly infinite set of coupled equations. In particular, it is shown how this infinite set of coupled linear equations can be reduced in general to finite set of 7 coupled linear algebraic equations. Accordingly, the normal modes of the system are obtainable from a 7×7 determinant. (auth)

11050 NONLINEAR WAVES IN A COLD PLASMA BY LORENTZ TRANSFORMATION. Clemmow, P. C. (Cambridge Univ., Eng.). J. Plasma Phys.; 12: No. 2, 297-317(Oct 1974).

Wave propagation in a cold, collisionless, two-component plasma is analyzed by considering, first, the frame of reference in which the field has no space dependence, and then applying a Lorentz transformation to obtain a wave whose space–time dependence is a function of $t-nz/c$ only, where n is a constant. Exact (nonlinear, relativistic) results for known special cases, and some others, are given; and it is shown that, when there

is no ambient magnetic field, the general problem in essence reduces to the solution of one second-order, nonlinear differential equation. The desirability of introducing a free parameter representing a stream velocity in the direction of wave propagation is emphasized; and the significance of the choice of this parameter is discussed. (auth)

11051 STUDIES ON PROPAGATION OF TRANSVERSE AND LONGITUDINAL WAVES IN A PLASMA. Soni, R. C. (LBS Coll., Jaipur, India); Bakore, P. V. Indian J. Pure Appl. Phys.; 12: No. 8, 561-564(Aug 1974).

The problem of propagation of longitudinal and transverse waves in a collision plasma was studied in a one-component classical hot plasma, using Boltzmann linearized equation and Maxwell's field equations. Dispersion relations for these waves were derived and discussed for particular cases of interest. The case of zero temperature region (ZTR) is also considered. The important results and conclusions emerging from the study are: (1) for transverse waves with an external magnetic field, it is shown that in the ZTR, a vlf mode of the wave does not exist at all, while in the collisionless case a type of resonance occurs in the hf waves, the resonant frequency being independent of the plasma temperature; (2) when an external weak magnetic field is present, the results so obtained in the case of lf and hf wave propagation are in close agreement with those given in (1) above, strongly supporting our isotropic and magnetoactive picture of a plasma; and (3) for longitudinal waves it has been shown that in the ZTR, both average fraction of energy lost by the electron in one elastic collision and collision frequency play a significant role in the damping of vlf waves. This particular result differentiates a longitudinal wave from a transverse wave; in transverse waves the damping is mainly due to collisions. (auth)

11052 EXCITATION OF CYCLOTRON ELECTROMAGNETIC WAVES IN A MAGNETOACTIVE PLASMA BY AN ELECTRON STREAM. Yip, W. K. (Otago Univ., Dunedin, N. Z.). Plasma Phys.; 16: No. 9, 781-790(Sep 1974).

The rate of growth for cyclotron electromagnetic waves at arbitrary wave-normal angles in a system consisting of a helical electron stream plus a cold magnetoactive plasma is derived by means of the classical kinetic approach. The expression for the rate of growth is illustrated graphically with parameters appropriate to the active solar corona conditions. (auth)

11053 EXPERIMENTAL STUDY OF TORSIONAL ALFVEN WAVES IN A CYLINDRICAL PARTIALLY IONIZED MAGNETOPLASMA. Mueller, G. (Univ., Stuttgart). Plasma Phys.; 16: No. 9, 813-822(Sep 1974).

An experiment is described in which torsional Alfven waves are excited in a magnetized, partially ionized plasma column. Measurements of the propagation and polarization of the wave field are compared with numerical solutions of the dispersion equation. With decreasing degree of ionization, collisional coupling of ions with neutrals leads to an increased Hall effect, which can be expressed in terms of an effective ion cyclotron frequency. Peaks in axial wave number and damping as well as a change in polarization are found at this frequency. Radial inhomogeneities of resistivity and plasma density lead to a radial variation in amplitude and phase of the wave field. (auth)

11054 POSSIBILITY OF MAGNETIC FIELD GENERATION BY LANGMUIR OSCILLATIONS. Vanshtein, S. I. (Siberian Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Irkutsk, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 2, 517-524(Aug 1974). (In Russian).

A new mechanism for magnetic field generation was obtained in which the energy of Langmuir oscillations transforms into that of a magnetic field. The odd parity (gyrotropic) property of the magnetic field oscillations resulting from the presence of a pseudovector, was used. The plasma was a collisional plasma. The nonlinear current and its response to the field were calculated. The condition (threshold) for instability and the rate of growth of the field were found. The rate depends on the initial field due to nonlinearity of the generation equation. The effect is discussed for a cosmic plasma and the experimental plasma. (auth)

11055 DYNAMICS OF FORMATION AND INTERACTION OF LANGMUIR SOLITONS AND STRONG TURBULENCY. Degtyaryov, L. M.; Makhan'kov, V. G.; Rudakov, L. I. (Inst. of Applied Mathematics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 2, 533-542(Aug 1974). (In Russian).

A model for studying strong Langmuir turbulence of Langmuir solitons i.e., of oscillation clusters localized in regions of low plasma density and produced under the action of a high frequency field pressure is presented. Formation of solitons from broad Langmuir wave packets and elementary processes involving solitons, such as merging of solitons in pair collisions, interaction between solitons and sound pulses, fragmentation of solitons by sound produced by merging of two solitons etc., were investigated with a computer in the one-dimensional case. A kinetic equation for a soliton gas is set up. Its solution is in satisfactory agreement with the results of a numerical simulation of one-dimensional Langmuir turbulence. (auth)

11056 GENERAL RADIO-FREQUENCY PROPERTIES OF BOUNDED PLASMA SYSTEMS IN CONNECTION WITH THE PRODUCTION AND HEATING OF DENSE PLASMAS. Vandenplas, P. E.; Messiaen, A. M. (Ecole Royale Militaire, Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 60: No. 4, 458-496(1974).

A review of the work done at the Laboratoire de Physique des Plasmas of the Ecole Royale Militaire and the references is presented. The following topics are covered: a brief review of the linear resonance properties of bounded plasma systems in the electron wave domain together with some applications to diagnostics and plasma coated antennas; the properties of radio-frequency resonantly sustained plasmas with densities high above critical density. It is stressed that these interesting plasma sources can be understood on the basis of the general resonance properties of bounded systems; and the absorption and resonance properties of hot-ion magnetized plasma columns in the magneto-ion domain, i.e., in that domain in which both the ions (largely because of the magnetic field) and the non-zero temperature of electrons play a significant role. (auth)

11057 INTERACTION BETWEEN LANGMUIR SOLITONS AND PLASMA CHARGED PARTICLES. Gorev, V. V.; Kingsep, A. S. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2048-2055(Jun 1974). (In Russian).

Evolution of the electron distribution function of a plasma was investigated. A power distribution law was established in the velocity range considerably exceeding thermal electron velocities. The dynamics of interaction between solitons and thermal ions was considered. It is shown that nonlinear damping of solitons by ions results in slowing down of the solitons without appreciable variation of their amplitude. The soliton mean free path was calculated. (auth)

11058 ELECTROMAGNETIC WAVE COLLAPSE IN A PLASMA. Kuznetsov, E. A. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2037-2047(Jun 1974). (In Russian).

The effect of longwave electromagnetic perturbations on collapse of Langmuir waves was studied. It is shown that at the initial stage both Langmuir and electromagnetic waves collapse in an isotropic plasma. In contrast to isotropic plasmas, collapse of electromagnetic waves occurs in plasmas with a weak magnetic field. Collapse results in the formation of filaments collapsing in a direction perpendicular to the magnetic field. (auth)

11059 SCATTERING OF hf ELECTROMAGNETIC WAVES BY AN ELLIPTICAL PLASMA CYLINDER AND THE GEOMETRICAL THEORY OF SURFACE WAVES. Zaboronkova, T. M.; Kondrat'ev, I. G. (Scientific-Research Radiophysical Inst., Gorky, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 9, 1269-1280(1974). (In Russian).

A self diffraction part of the field, occurring as a result of scattering of cylindrical and plane electromagnetic waves by an elliptical plasma cylinder and associated with excitation of quasi-surface waves guided by the cylinder surface, was investigated. The corresponding field expressions were obtained using the ray method at the complex eikonals and Lorentz lemma of calculation of the excitation coefficients of diffraction modes. The asymptotic solution obtained corresponds to the geometrical surface wave theory and may be considered as a valid theory for the objects with a variable curvature and as a certain generalization. The resonance effects caused by quasi-surface waves were analyzed on the basis of the given general formulas. (auth)

11060 WAVE–PARTICLE INTERACTIONS IN A BEAM–PLASMA SYSTEM. Nyack, C.A. (Physics Department, University of the West Indies, Cave Hill, Barbados); Christiansen, P.J. Phys. Fluids 17: No. 11, 2025-2029 (Nov 1974).

An experiment on large amplitude electrostatic waves is described, the results of which illustrate the phase velocity variations during the first bounce period predicted by the single–wave model. The spatial growth of sidebands, after the initial large amplitude wave has reached saturation due to nonlinear trapping effects, is also described. It is found that the amplitude of the phase velocity variation is proportional to $\phi^{1/2}$ (where ϕ is the wave amplitude) and that the slower phase velocity and higher–frequency sideband (for instability near the plasma frequency) are always the dominant ones. (auth)

11061 THRESHOLD CONDITIONS FOR ELECTRON TRAPPING BY NONLINEAR PLASMA WAVES. Canosa, J. (IBM Scientific Center, Palo Alto, California 94304); Gazdag, J. Phys. Fluids 17: No. 11, 2030-2039 (Nov 1974).

Numerical solutions of the nonlinear Vlasov equation show that the long time behavior of an electrostatic plasma wave depends critically on the value of the parameter $\gamma\tau$ (γ is Landau's damping coefficient and τ is the electron bounce time), both for large and small initial wave amplitudes. When the initial wave amplitude is large, the initial nonlinear damping is stronger than Landau damping; for smaller initial amplitudes, the behavior is initially described by Landau's theory. For both types of problems if $\gamma\tau > 0.5$, the wave damps monotonically; if $\gamma\tau < 0.5$, the numerical results indicate that the plasma performs amplitude oscillations. When $\gamma\tau \simeq 0.5$, the plasma displays its critical behavior; here, after some initial damping the wave amplitude levels off at a constant value. The critical behavior observed for mild nonlinear problems is in good agreement with the experimental results of Franklin, Hamberger, and Smith. For a moderately strong nonlinear wave displaying the critical behavior, the wave performs periodic oscillations with a frequency smaller than Landau's linear frequency; this frequency shift is explained because the uniform electron distribution develops a plateau centered at Landau's phase velocity. (auth)

11062 GENERAL THEORY OF ENHANCED INDUCED EMISSION IN PLASMAS. Oberman, C.; Auer, G. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Fluids 17: No. 11, 1980-1982 (Nov 1974).

A simple formalism yields a general expression for the enhanced induced emission in plasma influenced by a strong electromagnetic or electrostatic pump. Applications to subcritical Brillouin, Raman, and other resonant and nonresonant interactions are given. (auth)

11063 SELF–PRECESSION AND FREQUENCY SHIFT FOR ELECTROMAGNETIC WAVES IN HOMOGENEOUS PLASMAS. Arons, J.; Max, C.E. (University of California, Berkeley, California 94720). Phys. Fluids 17: No. 11, 1983-1994 (Nov 1974).

The nonlinear propagation of an arbitrarily polarized electromagnetic wave in a uniform plasma is studied. It is shown that nonlinear effects cause precession of the polarization ellipse as the wave propagates. The ellipticity remains constant, but the orientation of the principal axes is rotated relative to its initial value. A relativistic Vlasov model is used to study nonlinear frequency shifts as well as self–precession, in a plasma of arbitrary temperature. Even when $T_e \gg m_e c^2$, the qualitative nature of these two processes remains unchanged, although their dependence on the plasma density is altered in significant ways. Implications of these effects for plasma instabilities driven by strong electromagnetic waves are briefly discussed. (auth)

11064 APPLICATION OF ELECTROMAGNETIC PARTICLE SIMULATION TO THE GENERATION OF ELECTROMAGNETIC RADIATION. Lin, A.T.; Dawson, J.M. (Department of Physics, University of California, Los Angeles, California 90024); Okuda, H. Phys. Fluids 17: No. 11, 1995-2001 (Nov 1974).

A three velocity and one–space dimensional nonrelativistic electromagnetic particle simulation code employing the fast Fourier transform algorithm is described and used to simulate the amplification of electromagnetic radiation by an electron beam passed over a rippled static magnetic field. In the beam frame the rippled magnetic field looks like an intense electromagnetic pump and thus a parametric instability can be produced. In one case, it was observed that 30% of the beam energy was converted to electromagnetic radiation. (auth)

11065 NONLINEAR EXCITATION OF ION ACOUSTIC WAVES. Michelsen, P. (Association Euratom–AEK, Danish Atomic Energy Commission, Research Establishment Risø, Roskilde, Denmark); Hirshfield, J.L. Phys. Fluids 17: No. 12, 2205-2207 (Dec 1974).

The excitation of ion acoustic waves by nonlinear coupling of two transverse magnetic waves generated in a microwave cavity was investigated. Measurements of the wave amplitude showed good agreement with calculations based on the Vlasov equation. (auth)

11066 ION CYCLOTRON WAVES AND FAST WAVES IN A TOROIDAL CAVITY. Swanson, D.G. (Department of Electrical Engineering, The University of Texas at Austin, Austin, Texas 78712). Phys. Fluids 17: No. 12, 2241-2248 (Dec 1974).

The propagation of ion cyclotron waves and fast waves in a toroidal cavity with a spatially varying static magnetic field as in a tokamak or stellarator is examined. Using a cold plasma model in a square cross section conducting toroidal cavity and neglecting effects of electron inertia, the wave equation is reduced to an ordinary differential equation which is numerically integrated subject to boundary conditions to find eigenmodes which represent cavity resonances. For the fast wave, only very small perturbations from the corresponding uniform plasma guide problem are found, and it is concluded that effects of toroidicity on the fast wave are not significant. For the ion cyclotron wave it is found that the region of propagation is generally confined to the high magnetic field side of the cyclotron resonance and for low order modes vertically and azimuthally, the region of propagation does not extend to the resonance location. A new type of wave behavior appears due to toroidicity which is similar to the ion cyclotron wave but depends differently on wavelength and may be important for fusion plasma heating because of its possibly greater accessibility. On the basis of the wave profiles, optimum antenna designs will be profoundly affected by toroidicity. (auth)

11067 OBSERVATION OF ANOMALOUS SOFT X–RAY EMISSION FROM A TURBULENTLY HEATED HIGH VOLTAGE θ–PINCH. Oktay, E. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Fluids 17: No. 12, 2261-2266 (Dec 1974).

Soft x–ray emission from the Maryland high voltage θ–pinch is measured as a function of two experimental parameters which in effect determines the electron density in the initial plasma. The x–ray intensity increases rapidly as the electron density is lowered; however, the electron temperature deduced from thin foil absorption of these x rays does not vary significantly. The absolute intensity of these about 3–keV x rays is orders of magnitude larger than the calculated intensity of bremsstrahlung radiation. To enhance x–ray emission, we put a small Cu target in the plasma, and measure absorption characteristics and intensity of these target x rays also. The time of x–ray emission correlates with those of neutron emission and implosion of magnetic field on the axis. (auth)

11068 SYNCHROTRON RADIATION SPECTRUM FOR AN INTENSE RELATIVISTIC E–LAYER. Davidson, R.C. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Mahajan, S.M. Phys. Fluids 17: No. 12, 2267-2274 (Dec 1974).

The synchrotron radiation spectrum is calculated for an intense relativistic nonneutral E layer including self–field effects. The analysis is carried out for the class of thin E–layer equilibria described self–consistently by equilibrium distribution functions of the form $f^0_e(x,p) = R_0 F(H)\, \delta\,(P_\theta - P_0)$, where H is the energy, P_θ is the canonical angular momentum, and R_0 and P_0 are constants. Since individual electrons execute radial betatron oscillations about a helix with mean radius R_0, the single–particle emission spectrum is modified from the conventional Schott–Trubnikov result. To determine the spectrum of radiation emitted by all electrons in the E layer, the single–particle emission spectrum is averaged over the distribution function $f^0_e(x,p)$ that self–consistently generates the E–layer equilibrium. (auth)

11069 ANOMALOUS DISSIPATION OF ENERGY OF ELECTROMAGNETIC WAVES IN A COLLISIONLESS MAGNETOACTIVE PLASMA. Batanov, G. M.; Sarksyan, K. A. Tr. Fiz. Inst., Akad. Nauk SSSR; 73: 104-147(1974). (In Russian).

Experimental studies were made of the interaction of ultra-high-frequency pumping waves with collisionless magnetoactive plasma in the frequency range $\omega_{Le} < \omega_0 < \omega_{He}$, where linear transformation of waves is not possible. Anomalous dissipation of energy of the ultra-high-frequency pumping waves in a plasma develops in such anomalous effects as absorption of energy of the ultra-high-frequency waves, heating of the electrons, and non-thermal radiation of the plasma. The effects are related to activation in a magnetoactive plasma of parametric instability with varying high- and low-frequency plasma oscillations. (tr-auth)

11070 NONLINEAR PENETRATION OF AN ULTRAHIGH-FREQUENCY FIELD IN THE LAYER OF DENSE COLLISIONLESS PLASMA. Batanov, G. M.; Silin, V. A. Tr. Fiz. Inst., Akad. Nauk SSSR; 73: 87-103(1974). (In Russian).

Experimental studies were made of the clear layer of dense plasma ($\omega_{Le} > \omega_0$) upon interaction with ultra-high-frequency radiation of the 10-cm range. Penetration of radiation through the plasma layer was recorded under conditions when the wave pressure was lower than the plasma pressure. Changes in distribution of concentration of charged particles due to incident radiation and the intensity of the heating of the electron gas were recorded. In the spectrum of the ultra-high-frequency radiation that penetrated the plasma layer or the dispersed layer, lines were observed displaced to the field of frequencies lower than the frequency of the incident wave and its secondary harmonics, which allowed relating the observed phenomena to the development of turbulence of the plasma due to its parametric instabilities in the ultra-high-frequency field. (tr-auth)

11071 EXPERIMENTAL STUDY OF QUASIPOTENTIAL INTERACTION OF HETEROGENEOUS SUPER-HIGH-FREQUENCY FIELDS WITH PLASMA AND CONDITIONS OF ITS EXISTENCE. Sergeichev, K. F.; Gekker, I. R. Tr. Fiz. Inst., Akad. Nauk SSSR; 73: 3-36(1974). (In Russian).

Experiments on the movement of currents of completely ionized rarefied plasma ($\omega_0 \gg \omega_{Le} \gg \nu_{ei}$) in a weakly heterogeneous super-high-frequency fields of waveguides showed that reflection, acceleration, and focusing of the plasma by the fields correspond to what is predicted by the theory of quasi-potential interaction.

With an increase in the plasma concentration, when ω_{Le} approaches ω_0, disintegration starts. Study of the limit of plasma transition to an unstable state showed that it corresponds to the threshold dependence of parametric instability of the plasma in a super-high-frequency field. (tr-auth)

11072 DUPREE–WEINSTOCK TURBULENCE THEORY. Peyraud, N.; Coste, J. (Univ., Nice). J. Plasma Phys.; 12: No. 2, 177-198(Oct 1974).

A necessary criterion of validity for the Dupree-Weinstock (Dupree, T. H. 1966 Phys. Fluids, 9: 1773. Weinstock, J. 1969 Phys. Fluids, 12: 1045) theory of turbulence is given. In this connection, two specific cases of high-frequency (hf) and low-frequency (lf) turbulence are analyzed. In the hf case, it is shown that an appreciable modification of the growth rate of unstable modes cannot occur before trapping. (auth)

11073 WAVE PROPAGATION IN A MOVING PLASMA. II. Wave Propagation Along, and Plasma Motion Normal to, the Magnetic Field. Srivastava, D. N. (Bhabha Atomic Research Centre, Bombay). J. Plasma Phys.; 12: No. 2, 271-278(Oct 1974).

The dispersion relation for a collisionless moving electron plasma was analyzed, when the direction of motion is normal to the magnetic field and that of the wave propagation along the magnetic field. It is shown that, in strong magnetic fields, the one continuous allowed band of the left-handed wave (of the stationary plasma) splits into two, and the right-handed wave shows a second resonance besides the cyclotron resonance. In weak magnetic fields, the left-handed wave develops a backward wave band, which shows resonance at its low frequency edge, and the right-handed wave also develops an extra band of propagation. The effect of the motion of the plasma, on waves of frequency much lower than the plasma frequency, is identical to a doppler shift, but, on those of frequency much higher than that, is negligible. (auth)

11074 COHERENT RADIATION OF QUASI PERPENDICULAR ELECTROSTATIC WAVES FROM AN ELECTRON BEAM. Lavergnat, J. (Centre National de la Recherche Scientifique, Saint-Maur-des-Fosses, France); Ram Pal Singh; Pellat, R. Delft Progr. Rep., Ser. B; 278: No. 17, 763-765(22 Apr 1974). (In French).

Theoretical study of the coherent emission from an electron beam in Bernstein modes is presented. The results obtained are compared with the experiment. (FR)

11075 NEUTRALIZATION WAVE OF AN ELECTRON BEAM INJECTED INTO A PLASMA. Lavergnat, J. (Centre National de la Recherche Scientifique, Saint-Maur-des-Fosses, France). Delft Progr. Rep., Ser. B; 278: No. 18, 827-829(29 Apr 1974). (In French)

The neutralization wave accompanying an electron beam injected into a plasma is calculated and its influence on coherent wave emission is shown. (FR)

11076 EFFECTS OF ROTATIONAL ENERGY ON THE NONLINEAR EVOLUTION OF COLLISIONLESS BEAM–PLASMA SYSTEMS. Kazek, G. J. Cleveland; Case Western Reserve Univ. (1974). 156p. University Microfilms Order No. 74-25,663.

Thesis (Ph. D.).

The nonlinear time evolution of a magnetized cold electron beam–cold plasma system is examined under the assumptions that the ratio of beam to plasma density is a small parameter and that a significant fraction of the beam energy is associated with motion across the static magnetic field. Analyses of the system's linear dispersion relation and linearly perturbed particle trajectories indicate that electrostatic instability may be driven by the beam's rotational energy when a cyclotron harmonic wave on the beam is synchronous with a wave in the background plasma. The analyses also show that the background plasma may be treated as a linear dielectric in the determination of the system evolution. Numerical solutions of the equations of motion for beam particles interacting with a single wave reveal that nonlinear stabilization of the wave occurs due to phase mixing of beam particles in velocity space and that only a small fraction of the beam's rotational energy may be transferred to the wave and background plasma. For a system initially uniform in space and with wave propagation across the magnetic field, beam particles execute trapped particle motion in velocity space. The inclusion of wave propagation partially along the field indicates that spatial, in addition to velocity, bunching of beam particles will occur. The spatial bunching is a manifestation of the coupling of particle motions along and across the static field by the wave. The evolution of the beam velocity distribution as viewed in a phase space related to particle velocities and positions along the static field is qualitatively similar to the result obtained for the one-dimensional beam–plasma interaction. (Diss. Abstr. Int., B)

11077 ACCESSIBILITY TO THE LOWER HYBRID RESONANCE. Artico, G.; Spigler, R. (Univ., Padua). Plasma Phys.; 16: No. 11, 1103-1106(Nov 1974).

The problem of the accessibility to the lower hybrid resonance for a wave propagating in a cold homogeneous plasma, filling the half space $x \geq 0$ with a density gradient ∇n parallel to the x axis, in a uniform static magnetic field B_0 perpendicular to the x axis and making an angle φ with the direction of the wave vector component perpendicular to ∇n is considered, taking into account a rotational transform for the $m = 0$ mode. (UK)

11078 COMMENTS ON "THE EFFECT OF GRADIENTS OF DENSITY AND STATIC MAGNETIC FIELD ON THE PROPAGATION OF SURFACE WAVES AND THE WAVE-BEAM INTERACTION" AND AUTHOR'S REPLY. Uberoi, C. (East Anglia Univ., Eng.); El-Siragy, N. M. Plasma Phys.; 16: No. 11, 1107-1108 (Nov 1974).

In order to study the effect of axial inhomogeneity of plasma density and the magnetic field on the surface waves propagating along the boundary of a semi-infinite plasma, Demchenko et al (Demchenko, V. V., El-Siragy, N. M. and Hussein, H. M. (1973) Plasma Phys. 15: 1272) have chosen the dielectric permittivity dependence on z as $\varepsilon(z) = \{[1-(\omega_{pl}^2/\omega^2)](\alpha^m/z^m)\}$, where m is an integer, $\alpha > 0$ is a constant and ω_{pl} is a constant plasma frequency. The choice of dielectric constant gives $\omega_p^2(z) = \omega^2\{1-[1-(\omega_{pl}^2/\omega^2)](\alpha^m/z^m)\}$ i.e., the density profile of the plasma is taken to be dependent on the wave-frequency ω, which is manifestly incorrect. In reply the authors state that for a fixed frequency ω the density profile of the plasma depends on the spatial coordinate z only and not on ω. This choice led to the second equation but this does not mean that $\omega_p(z)$ is a function of ω. (auth)

11079 MEASUREMENT OF SCATTERING OF MICROWAVE RADIATION BY LOW-FREQUENCY TURBULENT PLASMA OSCILLATIONS. Zhivotov, V. K.; Kalinnikov, G. I.; Kingsep, A. S.; Krotov, M. F.; Rusanov, V. D.; Tarasov, Yu. V. Zh. Eksp. Teor. Fiz.; 67: No. 1, 84-88(Jul 1974). (In Russian).

The Raman scattering spectrum was measured in the millimeter range by means of interference filters; the frequency of the plasma oscillations is approximately twice the ion Langmuir frequency. The measurements are interpreted as resulting from interaction between the radiation and helicons. The helicon field strength is estimated. (auth)

11080 SPACE–TIME FOCUSING OF AN ION BEAM EXCITING TRANSVERSE ION LANGMUIR PLASMA OSCILLATIONS. Katsubo, L. P.; Kovalenko, V. P.; Soloshenko, I. A. (Inst. of Physics, Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 1, 110-117(Jul 1974). (In Russian).

The nonlinearity mechanism on excitation of transverse ion Langmuir plasma oscillations modulated by an ion beam whose velocity considerably exceeds that of the ion sound was investigated. It is shown that restriction of the oscillation amplitude is related to intersection of the beam particle trajectories resulting from space–time focusing of the oscillations in a direction transverse with respect to that of the unperturbed beam velocity. (auth)

11081 NONLINEAR LANDAU DAMPING IN AN INHOMOGENEOUS PLASMA. Karpman, V. I.; Shklyar, D. R. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 102-109(Jul 1974). (In Russian).

A theory of nonlinear damping (growth) of Langmuir waves in a collisionless inhomogeneous plasma is developed for the case when the plasma inhomogeneity exceeds the critical value for which particle capture by a wave potential well becomes impossible. An expression for the wave increment is derived and investigated as a function of the field amplitude and the inhomogeneity parameter throughout the whole region of these parameters in which there are no captured particles. (auth)

11082 IGNITION AND MAINTENANCE OF SUBSONIC PLASMA WAVES IN ATMOSPHERIC PRESSURE AIR BY CW CO_2 LASER RADIATION AND THEIR EFFECT ON LASER BEAM PROPAGATION. Fowler, M.C.; Smith, D.C. (United Aircraft Research Laboratories, East Hartford, Connecticut 06108). J. Appl. Phys. 46: No. 1, 138-150 (Jan 1975).

Laser supported combustion (LSC) waves, subsonically propagating plasma, are ignited from solid targets and maintained in atmospheric pressure air using focused high–power, as high as 15 kW, cw CO_2 laser radiation. The intensity necessary to ignite LSC waves, I_i, is measured for steel and aluminum targets as a function of beam focal spot diameter and wind velocity transverse to the beam axis as is the intensity needed to maintain such waves in atmospheric pressure air, I_m. In the absence of a transverse wind, the quantities I_i and I_m are essentially identical for diameters smaller than 0.1 cm, but I_i is substantially larger at larger diameters. The reason for this is discussed

in terms of the ignition mechanism itself. In the presence of a 20—m/sec transverse wind, I_m and I_t are essentially identical at 0.2 cm, the largest diameter for which I_t was determined. The measurements of I_m extend to 0.5 cm beam diameter and indicate, in the absence of the transverse wind, that while thermal conduction determines the value of I_m at small (0.007 cm) beam diameters, radiative losses are important at the larger diameters considered. An interferometric technique is utilized to obtain spatially resolved LSC wave plasma properties, and the latter are used to calculate the decrease in focal spot laser intensity due to absorption and refraction by the plasma. The calculated results, as well as those obtained from independent experiments, indicate that while inverse bremsstrahlung absorption can account typically for a 50% loss in focal spot intensity, scattering or beam blooming by the plasma has a significantly greater effect as the LSC wave propagates away from the focal spot. (auth)

11083 PHASE FRONT STRUCTURE OF MIXED LONGITUDINAL WAVES IN A MAGNETIZED PLASMA. Roberts, V. D.; Muelder, S. A.; Gruber, S. (Case Western Reserve Univ., Cleveland). Plasma Phys.; 16: No. 11, 1069-1084(Nov 1974).

The phase front structure of waves produced by the mixing of two longitudinal, electrostatic waves in a warm, collisionless plasma in cylindrical geometry is studied. Specifically, a cyclotron harmonic wave and an ion acoustic wave are launched approximately perpendicular to an applied magnetic field from opposite sides of a plasma column. Their interaction generates cyclotron harmonic waves at the sum and difference frequencies. The relative phases of the mixed waves are measured and found to be in good agreement with those predicted by the Boltzmann-Vlasov equation. (auth)

11084 TURBULENT SOUND IN PLASMA. Andreev, N. E.; Pustovalov, V. V.; Silin, V. P.; Tikhonchuk, V. T. Kratk. Soobshch. Fiz.; No. 1, 31-37(1974). (In Russian).

It was shown that in turbulent gas of plasma waves, slightly damped low-frequency waves—turbulent sound (second plasmon)—exist because of their induced scattering on ions. The spectrum of the turbulent sound was studied and its role in the establishment of parametric turbulence in plasma is discussed. (tr-auth)

11085 HYDRODYNAMIC THEORY OF THE FLUCTUATION OF THE SURFACE WAVE IN NON-HOMOGENEOUS PLASMA. Aliev, Yu. M.; Bukovich, S.; Gradov, O. M.; Kirii, A. Yu. Kratk. Soobshch. Fiz.; No. 2, 33-35(1974). (In Russian).

The results of the theory of steady fluctuations of surface waves in plasma with blurring of the boundary are briefly discussed. It is shown that the approximation of the sharp boundary in the quasistatic frequency region is not applicable. For this case, an expression was obtained for complex correlation lines of the field along the boundary which is completely determined by the inhomogeneity of the plasma density near the boundary. (tr-auth)

11086 ROLE OF TRANSITION REGION IN PROBLEMS OF SCATTERING ELECTROMAGNETIC WAVES AT RADIALLY INHOMOGENEOUS PLASMOIDS. Krepak, V. N.; Nazarenko, L. A.; Yakimenko, I. P. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 18: No. 11, 1629-1631(Nov 1973).

Translated from Radiotekh. Elektron.; 18: No. 11, 2225-2228 (Nov 1973).

The scattering of electromagnetic waves at radially inhomogeneous plasmoids (sphere, cylinder) is investigated using the method of approximation of an inhomogeneous medium by a layered medium (discrete model of continuous medium). This method is generalized to the case where the real part of the dielectric constant becomes zero. The transition region (Re $\epsilon = 0$) is considered as a component part of the object. The results of numerical computations illustrate the effect of this region on the scattering characteristics. (auth)

11087 COMPLETE ELECTROSTATIC SPECTRUM OF MAGNETOPLASMA SLABS. de Santis, P.; Franceschetti, G. (Univ., Naples). Alta Freq.; 42: No. 10, 557-559(Oct 1973).

The results are reported of a study to calculate the complete electrostatic spectrum of an infinite slab of plasma magnetized in its plane. A lossless dielectric characterization was adopted for the plasma. This is preliminary to studies wherein the dielectric tensor is a complex quantity (as in semiconductor plasma). (MOW)

ENGINEERING

11088 (CONF-740814-(Absts.)) AINSE ENGINEERING CONFERENCE, 19–21 AUGUST 1974, LUCAS HEIGHTS, N.S.W. Abstracts of Papers. (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). [nd]. 76p. Dep. NTIS (US Sales Only) $7.00.

Abstracts of sixty-papers are presented. Topics include: energy and nuclear power, fuel cycle, control systems, fuel elements, and mechanical aspects, energy conversion, heat and mass transfer, turbulence, fluid flow, fluctuation and noise analysis. (AT)

Energy Conversion

11089 (CONF-740470-1) SOLAR VS NUCLEAR POWER: IS THERE A CHOICE? Raab, B.; Karlin, J. J. (Fairchild Space and Electronics Co., Germantown, Md. (USA)). 1974. Contract AT(49-15)-3063. 14p. AIAA Libr., New York, NY.

From fifth AIAA communications satellite systems conference; Los Angeles, California, USA (22 Apr 1974).

The anticipated development of advanced high-performance radioisotope power systems has motivated a new evaluation of their possible utility in earth-orbit missions. These have been compared, in detailed spacecraft design studies, with current and improved oriented-solar-array/battery systems in commercial synchronous-orbit application. It is concluded that the nuclear systems would be economically superior to current solar systems, including violet cells, and potentially competitive with systems employing nickel-hydrogen batteries. This results in part from significant reductions in housekeeping power, and in the weights of other subsystems, which can be achieved with nuclear power. (auth)

11090 (UCRL-76051) DIRECT CONVERSION OF PLASMA ENERGY TO ELECTRICITY FOR MIRROR FUSION REACTORS. Moir, R. W.; Barr, W. L.; Carlson, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Sep 1974. 17p. (CONF-741105-44). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Direct conversion of both plasma and ion beam energy to electricity for mirror fusion reactors is described. Selective leakage, magnetic expansion, electron separation, deceleration, and collection of ions are discussed. An experiment testing all processes except selective leakage gave an overall efficiency of 86.5 ± 1.5% for a 22-stage collector. Computer calculations of these same processes gave an efficiency of 88.6 ± 1.5%, considered excellent agreement. Experiments on a two-stage collector gave 65% efficiency compared to 69% calculated efficiency. One-, two-, and 22-stage converters were studied under reactor-like conditions with a large computer simulation code that accounts for space charge, secondary electrons, and finite, realistic electrode shapes. The converters efficiencies are estimated to be 48%, 58%, and 63%, respectively. The efficiencies under the assumed reactor conditions are lower than under controlled laboratory conditions (86.5%). The one-stage converter is more cost effective than the two-stage converter, which in turn is more cost effective than the 22-stage converter; although more collector stages give higher efficiency, the simpler converters can handle more power. Conversely, if higher efficiency were desired, the studies show that it can always be achieved—but at a price. Laboratory tests of mono-energetic beam direct conversion gave 96% efficiency for a 2-keV low power dc beam and 70% for a dc 20 keV, 1-kW beam. The same computer code mentioned above is being used to design practical direct converters that reduce power requirements of neutral beam injectors in the 100 to 200-keV range. (auth)

11091 THERMOELECTRIC MICROGENERATOR STRUCTURE. Alais, M. (to CIT-ALCATEL). French Patent 2,168,672. 20 Jan 1972. 9p. (In French).

The long-life thermoelectric microgenerator for powering a cardiac pacemaker uses a cylinder containing a radioactive isotope (plutonium-238) as the heat source and the human body as the heat sink. The connection between the heat source and the thermoelectric element is achieved by means of a poorly electrically conductive resilient substance. The remaining portion of the heat source is surrounded by a space which has a very high impedance to the transfer of heat. (FR)

11092 RADIOISOTOPIC THERMIONIC CONVERTER. Rason, N. S.; De Steese, J. G.; Gasper, K. A. (to McDonnel Douglas Corp.). US Patent 3,843,896. 22 Oct 1974. Filed Date 4 Feb 1972. 34p.

An atomic diode battery or thermionic converter is described including a radioisotopic fuel pellet enclosed in a capsule having an emitter surface extending over substantially the entire capsule external area, a housing enclosing the emitter capsule and having an internal collector surface extending over substantially the entire housing internal area and maintained at a predetermined spacing from the emitter surface, a cesium vapor source communicating with the interelectrode space under such low vapor pressure as to effect nominally vacuum mode operation, and emitter and collector connections providing an electrical output from the battery. An optimum relationship established among battery parameters provides maximum energy conversion efficiency at practical electrode temperatures and spacings using available materials. (Official Gazette)

11093 THERMOELECTRIC GENERATOR. Winkler, J.; Falkenberg, D. (to Siemens Aktiengesellschaft). US Patent 3,830,664. 20 Aug 1974. Priority Date 24 Oct 1968, F. R. Germany. 6p.

A thermoelectric generator is described that includes a chamber containing radioactive nuclides as a heat source and is surrounded by thermocouple elements formed of respective pairs of thermocouple element legs having a hot side facing toward and a cold side facing away from the chamber, and shielding means comprising a pair of telescoped hollow members fully surrounding the chamber, the thermocouple element legs being located in the interior of the inner hollow member of the telescoped pair at locations thereof where the walls of the hollow members overlap, the respective pairs of thermocouple element legs being connected at their cold side by a contact bridge which is firmly connected mechanically to the wall of the inner hollow member so that the walls of the hollow members serve as heat exchanger for the cold side of the pairs of thermocouple element legs. (Official Gazette)

11094 DIRECT ION ENERGY CONVERSION IN OPEN MAGNETIC TRAPS. Vinogradova, O. A.; Dimitrov, S. K.; Zhitlukhin, A. M.; Luts'ko, A. S.; Smirnov, V. M.; Tel'koskii, V. G. Sov. At. Energy (Engl. Transl.); 36: No. 3, 273-275(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 221-222(Mar 1974).

The experimental arrangement includes an ion source, accelerating lens, focusing lens, rotating Faraday cups, diaphragms for removing electrons from the beam, and a system of skewed diaphragms. The efficiency of the system was determined in the 3 to 10 keV range for the ion beams. Several beam configurations were studied. (MOW)

11095 ELECTRICAL CONDUCTANCE AND RADIATION OF ARGON PLASMA CONTAINING CONDENSING NATURAL COAL ASH. Sinaisky, N.A.; Yavorsky, I.A. (Institute of Physicochemical Foundations of Processing of Mineral Raw Materials, Siberian Branch of USSR Academy of Sciences, Novosibirsk, 630091, USSR); Volkov, Y.M. J. Appl. Phys. 46: No. 1, 178-182 (Jan 1975).

A study has been made of the electrical conductance and radiation of a colloidal plasma consisting of a mixture of argon and aluminium particles condensing from the gas phase or argon with the mineral part of natural coals also condensing from the gas phase. This plasma has revealed an almost tenfold conductivity increase as compared to a colloidal plasma from prefused particles of the same minerals. It has also been found that there is a correlation between the growth in plasma conductivity and the condensation process, its radiation extremum and crystallization process. The nonequilibrium conductivity value of such a plasma (1–2 mho/m) at 2700–2500 °K, with an ash concentration up to 0.1%, makes it suitable for use in MHD generators without readily ionizable alkaline additives. (auth)

Facilities and Equipment

Refer also to abstract 11579.

11096 (AERE-Trans-1132) CAUSES OF POOR HEAT TRANSFER IN SHELL-AND-TUBE HEAT EXCHANGERS DURING CONDENSATION OF SATURATED STEAM. Forgo, L. Translated by J. W. Newmarch Holmes from Brennst.-Waerme-Kraft; 19: No. 1, 20-23(1967). 10p. Dep. NTIS (US Sales Only) $4.00 UK 9 pence.

The evolution of inert gases from condensing steam results in non-uniform heat loads and thus in reduced heat exchanger efficiency. The causes and effects of this reduced efficiency are discussed, together with methods of avoiding it. (auth)

11097 (HEDL-TME-72-145(Rev.1)) DEVELOPMENT FACILITIES. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-2170. 266p. AT.

The various development facilities available at HEDL for use in the FFTF/LMFBR Program, are described. The facilities encompass: The Fast Flux Test Facility (FFTF) Reactor Plant as a test bed; the High Temperature Sodium Facility (HTSF), a nonradioactive large component test facility; general sodium facilities; hydraulics laboratory; fuel fabrication facilities, fuel examination facilities, chemical and microstructural analysis laboratories, and supporting laboratory capabilities. Facilities utilization is based on priorities of the various programs with the FFTF having the highest priority. The facilities are capable of modification to suit the specific test requirements. Sufficient detail is provided in this report to permit assessment of use for participants in the LMFBR Program. Additional details may be obtained from the Hanford Engineering Development Laboratory. (auth)

11098 (PB-235084) BASIC UNDERSTANDING OF EARTH TUNNELING BY MELTING. VOLUME I. Basic Physical Principles. Final Report, April–September 1973. Black, D. L.; Chi, J. W. H.; Smith, R. A.; Roberts, D. B. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Jul 1974. Contract DOT-TSC-591. 183p. (DOT-TSC-OST-74-6-1). NTIS $5.50.

A novel technique, which employs the melting of rocks and soils as a means of excavating or tunneling while simultaneously generating a glass tunnel lining and/or primary support, was studied. The object of the study was to produce a good basic understanding of the fundamental process, its limits and capabilities, as applied to large scale (approximately 10 M diameter) transportation tunnels. A description of process is developed through the use of functional flow diagrams, from which five modes of thermal tunneling are defined, ranging from complete debris consolidation into the liner to complete extrusion and removal of the debris. For calculation purposes, five geologic modes of the near-surface continental crust are presented representative of approximately 95% of the total land area, from unconsolidated sediments to igneous rocks. Thermophysical properties are synthesized from the composition of the components. (auth)

11099 (SAND-74-8613) SHELL SHOCK STRUCTURAL CODE. Grant, J. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 9p. (CONF-741001-33). Dep NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

SHELL SHOCK is a computer code that performs a frequency analysis and determines the static and dynamic response of any structure represented by mass, damping, and stiffness matrices. These matrices may be found directly by the user, formed internally by the code from a finite-element model, or formed by a combination of the two methods. SHELL SHOCK is primarily intended for analyzing three-dimensional axisymmetric structures modeled using structural elements generated by the code in which the spatial coordinates are uncoupled by Fourier harmonics. A three-dimensional axisymmetric structure is then reduced to a series of two-dimensional problems, which significantly reduce the computations required. Three types of structural elements (that are uncoupled by a Fourier series) are generated internally by the code: linear beams, shells, and solids of revolution. Nonlinear beam elements under certain conditions can also be uncoupled and are included in the dynamic response computations. (auth)

11100 (UCRL-76202) EARTHQUAKE EFFECTS ON LLL FACILITIES. Tokarz, F. J.; Murray, R. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. 9p. (CONF-741001-30). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The performance of critical LLL facilities when subjected to severe earthquake loadings is being evaluated. Seventeen LLL facilities at Livermore, Site 300 and the Nevada Test Site are included in this study. These facilities are identified, the seismic criteria used for analysis are identified and the various methods of structural analysis currently available are outlined. The use of computers to perform the various steps in the analysis is indicated and references to the programs are given. Computer-generated results for one LLL facility are included as an example. (auth)

11101 VACUUM DRUM FILTER (16 MAR 1969) (ENGINEERING MATERIALS). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). (CAPE-2395).

7 drawings.

11102 VDF DRUM FILLER PIECE (22 NOV 1967)(ENGINEERING MATERIALS). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). (CAPE-2396).

1 drawing.

11103 PLUTONIUM STORAGE VAULT (6 MAY 1971)(ENGINEERING MATERIALS). (Hanford Engineering Development Lab., Richland, Wash. (USA)). (CAPE-2394).

7 drawings.

Seven drawings on architectural-structural aspects of the plutonium storage vault, 2736-Z Building, HEDL, are presented. The storage vault is designed and equipped to store Pu in metal oxide or scrap forms. It is a one-story structure (56 by 64 ft) of reinforced concrete, consisting of vault-type rooms (28 ft^2) serviced by a common corridor. (TFD)

11104 METHOD AND DEVICE TO PERFORATE GRAPHITE BODIES. Bildstein, H.; Knotik, K.; Wagner, H. (to Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna). Austrian Patent 5842/68/A. 18 Jun 1968. 11p. (In German).

Available from Oesterreichische Patentamt.

The invention concerns a new method and a new device for the dust-free perforation of graphite bodies for opening a graphite nuclear fuel compact by means of oxidizing mixtures of acids as well as concentrated nitric acid, peroxomono- or peroxodi-sulfuric acid, or their salts mixed with concentrated sulfuric acid. The graphite can be disintegrated by means of this mixture sprayed from a central lying nozzle to the graphite surface through a tube pressed close to the graphite body. This procedure makes possible the penetration of the tube–nozzle system into the graphite body and thereby the forming of perforation shape only dependent of the tube's profile. This method allows the removal of loosely packed fuel particles from a graphite nuclear fuel compact for the purpose of recycling. (INIS)

11105 HAZARDS CONTROL FILTER ASSEMBLY FOR SMOKE (16 AUG 1973) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.) (CAPE-2403).

4 drawings.

Lasers

Refer also to abstracts 10908, 10974, and 13292.

11106 (AD-778434) LASER PHYSICS: LIFETIME MEASUREMENTS, LINE PROFILE, HOLLOW CATHODE EXCITATION AND SATURABLE ABSORBERS. Final Report, 15 January 1969–14 January 1974. Bennett, W. R. Jr. (Yale Univ., New Haven, Conn. (USA). Dept. of Engineering and Applied Science). Jan 1974. 14p. (AFOSR-TR-74-0590). NTIS $3.00.

Research conducted in several areas of importance to laser theory and application is summarized. Precision methods were developed for the measurement of atomic lifetimes ranging from about one microsecond into the sub-nanosecond region. Lifetime measurements were reported for a large number of laser transitions in the noble gas ions (Ne II, Ar II, Kr II and Xe II), with limiting errors in the order of a few percent. Detailed studies of charge exchange and Penning excitation processes were reported in singly-ionized zinc and cadmium lasers, and many new cw laser transitions were reported in Zn II. Theoretical studies of scanning lasers, saturable absorber effects and frequency of stabilization methods were also conducted. Theoretical and experimental measurements of line shape analysis were performed and measurements reported for many noble gas ion laser transitions. (GRA)

11107 (AD-778478) CONSTRUCTION OF A FAR INFRARED LASER SYSTEM AND EVALUATION OF THE HCN LASER. Woskoboinikow, P. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Plasma Dynamics Lab.). Jan 1974. 110p. (RPDL-74-1). NTIS $4.50.

A flexible far infrared laser system has been constructed to operate in the 10 to 1000 micrometer regime. The system features demountable sections which allow the cavity length to be changed, different electrode structures to be employed, and detailed measurements of the plasma parameters to be made at several locations. This system has been evaluated by operating a glow discharge with methane and nitrogen gases to produce lasing on the 337 micrometer transition of HCN. The characteristics of the laser output power have been measured as functions of gas pressure, gas composition, and discharge current. In addition, the density measurements showed that the density profiles were sharper than the zero-order Bessel functions predicted from classical diffusion theory. This is perhaps

explained by the radially-dependent chemistry of the discharge. (auth)

11108 (AD-778672) INVESTIGATION OF NONLINEAR PROPAGATION AND CHIRPING OF SHORT CO_2 LASER PULSES. Annual Summary Report, 1 April 1969–28 February 1974. Berger, P. J.; Ferrar, C. M.; Smith, D. C. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). 28 Feb 1974. Contract N00014-69-C-0308. 145p. (UARL-N-92032-7). NTIS $4.75.

The generation of short pulses at 10.6 micrometer, basic properties of infrared lasers, and metal vapor lasers emitting in the blue-green were investigated. Significant developments include a Brewster angle acousto-optic modulator for high power mode-locking, a technique for pulse shaping based on gas breakdown, identification of gas breakdown as a limitation on high-pressure laser operation, a transverse-flow copper vapor laser operated at 50,000 pps, use of Ne as a buffer gas for high repetition rate copper vapor laser, and the absence of lasing from Bi vapor. (auth)

11109 (AD-778949) MEASURED N_2O–N_2 ABSORPTION AT FIVE DF LASER FREQUENCIES. Quarterly Report No. 9. Mills, F. S.; Long, R. K. (Ohio State Univ., Columbus (USA). Electroscience Lab.). Mar 1974. Contract F30602-72-C-0016. 34p. (ESL-3271-9; RADC-TR-74-89). NTIS $3.25.

Measurements of the absorption coefficients of N_2O–N_2 samples at five DF laser wavelengths are presented. A small grating-tunable pulsed DF laser was used in conjunction with a multi-traversal absorption cell having a path length for these experiments of 0.732 km. The results are compared with previously available experimental results and with calculated values. (auth)

11110 (AD-778958) TRANSIENT BEHAVIOR OF TRANSVERSE MODES IN HIGH-POWER PULSED LASERS. Final Report, 1 March 1971–31 December 1973. Deshazer, L. G. (University of Southern California, Los Angeles (USA). Electronic Sciences Lab.). 25 Feb 1974. 16p. (USCEE-470). NTIS $3.00.

Theoretical and experimental studies of the transient behavior of transverse modes in high-power Q-switched laser oscillators were performed. A computer analysis determined the transverse patterns for pulsed gain saturated lasers having Fresnel numbers up to 10, and the transverse intensity profiles of a passively Q-switched ruby laser oscillator were measured for several Fresnel numbers. The theoretical calculations predicted the experimental performance very well. A criterion for single-mode operation of passively Q-switched high-gain laser oscillators was determined empirically. The characteristics of the saturable absorber used as a Q-switch were shown to have only minor effect on the transient mode behavior. Analytical solutions of the diffraction of truncated Gaussian beams were developed to provide guidance for the computer calculations. (auth)

11111 (AD-780082) MEASUREMENT OF Ho^{3+}:YLF 2.06 MICROMETER LASER SPECTRAL OUTPUT VARIATIONS AND CO_2 ABSORPTION COINCIDENCE. White, K. O.; Watkins, W. R.; Schleusener, S. A. (Army Electronics Command, Fort Monmouth, N. J. (USA)). Apr 1974. 30p. (ECOM-5538). NTIS $3.25.

The spectral output of a multiply doped Ho^{3+}:YLF laser in the 2.06 micrometer region was measured using a 5-M grating spectrometer. The average spectral bandwidth of the laser output was found to be 0.5 NM. The laser output varied within a 1.5-NM range about 2.0646 micrometers. (auth)

11112 (AD-780622) HYDROGEN DISSOCIATION LASER. Cohn, A.; Rubin, A. G.; Besse, A. L. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). Apr 1974. 13p. (AFCRL-TR-74-0110). NTIS $3.00.

The H_2 dissociation laser buffered with Ar using electron beam excitation is considered. The Ar buffer greatly increases the light output from the upper laser level, compared with pure hydrogen. It does this by absorbing much more of the electron beam energy, and by transferring it more efficiently to the upper laser level. Upper laser level densities of 3×10^{13}/cc were experimentally obtained. This should be sufficient for practical gain if auxiliary loss processes such as photoionization absorption do not cancel the gain. This problem has not yet been determined. If these adsorption processes are within estimated bounds, an energy density of approximately 5 J/l, over a pulse time of about 10 nsec, at an efficiency of about 10% for tunable radiation in the 0.4- to 0.6-micrometer wavelength range is predicted. (auth)

11113 (AD-780728) STUDIES RELATIVE TO POSSIBLE LASER PUMPED BY NUCLEAR BETA RAYS. II. Power and Shielding Requirements. Morrison, C. A.; Wortman, D. E. (Harry Diamond Labs., Washington, D. C. (USA)). Jan 1974. 44p. (HDL-TR-1647). NTIS $3.25.

An investigation has been made of problems that would be encountered in providing for and using the nuclear power from the beta decay of ^{170}Tm to pump a rare-earth ion laser. The ^{170}Tm is to be created by bombarding $LiTmF_4$ containing stable ^{169}Tm by thermal neutrons. The rare earth impurity ion selected for the laser will substitute for a small amount of the thulium. It was found that exposing the $LiTmF_4$ crystal to a thermal neutron flux of 10 to the 14th power/sq cm-sec for 3 days could create a power density within $LiTmF_4$ comparable with that of a 100-W xenon lamp used for optically pumping HO (3+). The energy level of escaping radiation is low enough so that shielding to insure safe handling without compromising portability can be provided with no greater difficulty. Range calculations showed, for example, that the range of 1-MeV electrons in liquid nitrogen is only about 0.5 cm. Low-Z material can be used for shielding the beta rays because of the lower intensity bremsstrahlung that would be created thereby. (auth)

11114 (AD-780839) EXCITATION CIRCUIT FOR TEA GRID LASER. Lachambre, J. L.; Gilbert, J.; Cunningham, M. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). Mar 1974. 15p. (DREV-TN-2105/74). NTIS $3.00.

A novel circuit employing a combination of inductive and capacitive elements designed to excite a double discharge grid-type tea CO_2 laser is described. The electrical and amplification characteristics of the excited medium have been measured. Small-signal gain coefficients up to 0.025 cm were achieved with an electrical energy density of 100 MJ/cc being supplied to the discharge. (auth)

11115 (AD-780840) DOUBLE DISCHARGE TEA LASER BEAMS. Fortin, R.; Laflamme, A. K.; Rheault, F. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). Mar 1974. 34p. (DREV-TN-2109/74). NTIS $3.25.

The energy and power density distributions of a multi-transverse mode laser beam are predicted from a simple theoretical model. The corresponding experimental verifications show a good agreement for both the near and far field behavior of these beams. Finally, a method for optimizing the peak power density in the focal volume of a converging element is suggested. (auth)

11116 (AD-781440) SPECTRAL KINETICS OF GENERATION OF SOME ORGANIC LIQUID LASERS. Neporent, B. S.; Shilov, V. B.; Lukomskii, G. V. Translated from Opt. Spektrosk.; 35: No. 3, 535-539(1973). 11p. (NSIC-Trans-3529). NTIS $4.00.

The red shift of the spectra of generation of rhodamine 6 ZH and cryptocyanine solutions when excited by monopulses of solid body lasers was investigated. The relaxation character of the shift was confirmed by the dependence of the magnitude of spectra shift on pumping power. The decisive role of intramolecular relaxations was confirmed by the retention of the effect when the viscosity and temperature of the solutions change within broad limits. The absence of correlation between the shift of generation spectra and boundary losses in the resonator was established. (GRA)

11117 (AD-781443) ROLE OF NONRESONANCE EXCHANGE PROCESSES IN GAS-DYNAMIC LASERS. Biryukov, A. S.; Shelepin, L. A. Translated from Zh. Prikl. Mekh. Tekh. Fiz.; No. 4, 25-32(1973). 15p. (NISC-TRANS-3543). NTIS $4.00.

It was demonstrated previously that nonresonance vibrational exchange plays an important role in gas lasers. During scattering of gaseous mixtures, nonresonance exchange processes lead to appreciable redistribution of vibrational level populations and to variation of effective relaxation times. The possibilities of gas-dynamic lasers, related to adequate consideration of nonresonance exchange, are considered in the investigation. For analysis of the kinetics of the processes, a system of equations of the balance of vibration energies for a mixture of gases whose molecules are simulated by two types of harmonic oscillators was used. The presence of Boltzmann distribution of populations by levels with their own vibrational-band temperature was assumed in each of the components. (GRA)

11118 (AD-781475) NEUTRON AND GAMMA-RAY FLUXES FOR PUMPING LASERS. Roberts, T. G.; Shatas, R. A.; Stettler, J. D. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 1 May 1974. 16p. (RR-74-3). NTIS $3.00.

The feasibility of using an electron-beam-triggered thermonuclear explosion to produce neutron and gamma-ray fluxes of interest for studies of neutron pumped gamma lasers and gamma-ray pumped HF and Xe lasers is analyzed. An experimental scheme is proposed which seems to satisfy all the requirements for use of a high-energy electron beam. (auth)

11119 (AD-781731) CHEMICAL LASER STUDIES OF UNIMOLECULAR REACTION DYNAMICS. Sirkin, E. R.; Berry,

M. J. (Wisconsin Univ., Madison (USA). Dept. of Chemistry). 5 Jun 1974. Contract N00014-67-A-0128-0022. 6p. NTIS $3.00.

Measurements of hydrogen fluoride vibrational state populations in several unimolecular elimination laser systems indicate that 10 to 15% of the reaction exoergicity is channeled into HF vibration. The mode of reactant formation influences energy partitioning in $CH_3CH_2F(+)$ decomposition. (auth)

11120 (AD-782036) CHALCOGENIDE GLASSES FOR HIGH ENERGY LASER APPLICATION. Final Technical Report, 1 May 1973–30 April 1974. Hilton, A. R.; Hayes, D. J.; Rechtin, M. D. (Texas Instruments, Inc., Dallas (USA)). Jun 1974. Contract N00014-73-C-0367. 84p. (TI-08-74-44). NTIS $4.00.

New compounding techniques were devised to prepare high purity TI No. 1173 (GE28SB12SE60) and TI No. 20 (GE33AS12SE55). The methods were based on the combination of the reactant purification and compounding steps. The goal of the program was to establish the absorption limit for the glasses and to lower the absorption at 10.6 micrometers. Glasses based on sulfur and selenium were carefully characterized to establish the interdependence between chemical composition and the magnitudes of physical parameters related to their use as infrared optical materials. The sulfur glasses selected for evaluation were from the GE-SB-S system. The physical properties of sulfur glasses were substantially better than those of the selenium glasses. Visible transmission was found for glasses containing 60 or more atomic percent sulfur. However, chalcogenide glasses do not appear promising as high energy CO_2 laser window materials. (auth)

11121 (AD-782061) RESEARCH ON LEAD–TIN–TELLURIDE INFRARED EMITTERS AND DETECTORS. Final Report, 1 June 1972–15 March 1974. Oldham, W. G. (California Univ., Berkeley (USA). Coll. of Engineering). Mar 1974. 21p. (AFOSR-TR-74-1139). NTIS $3.00.

A program to develop practical widely tunable infrared lasers was begun. A Pb/p-type PbTe Schottky barrier technology for junction fabrication was developed. The process requirements for reproducible junctions were established. (auth)

11122 (AD-782544) KINETICS OF HIGH-PRESSURE CHEMICAL LASERS. Kochelap, V. A.; Kukibnyi, Yu. A. Translated by F. C. Vaughn from Ukr. Fiz. Zh. (Russ. Ed.); 18: No. 3, 378-388 (1973). 21p. (FTD-HT-23-860-74). NTIS $3.00.

The study of the kinetics of high-pressure chemical lasers is continued. The time evolution of the system in the neighborhood of the stationary state was studied. It is shown that depending on the relation of the parameters of the system and the pumping level, the approach to the stationary state has the nature of damped oscillations or of aperiodic motion. Detailed investigation of stationary states shows that conditions exist when with one and the same pumping power there are two different stationary states. The investigation of time equations points to the instability of states with lesser photon density. (GRA)

11123 (AD-782649) BLUE-GREEN LASER MATERIAL. Research Technical Report, 1 December 1971–30 November 1973. Linz, A.; Jenssen, H. P.; Gabbe, D. R.; Castleberry, D.; Douma, M. H. (Massachusetts Inst. of Tech., Cambridge (USA). Crystal Physics Lab.). 30 May 1974. Contract N00014-67-A-0204-0044. 145p. NTIS $4.75.

Laser action has been demonstrated in Xe flash lamp pumped crystals of Li(Y(1-X)TBX)F4, (TB YLF), at 545 nm. Research on top-seeded solution growth of scatter-free crystals is described, together with zone refining and other techniques for feed purification. A closed loop computer-controlled growth system is described which is suitable for commercial production of YLF and which does not require corrosive and poisonous cover gases such as HF. (auth)

11124 (AD-782871) H_2-Cl_2 CHEMICAL LASER PROGRAM. Part Three. Additional Arc Jet Laser Experiments. Final Report, February–June 1974. Emanuel, G.; Trost, J.; Ackerman, R. A.; Reiner, R. J. (TRW Systems Group, Redondo Beach, Calif. (USA)). Jun 1974. Contract DAAH01-73-C-0446. 67p. (RK-CR-74-9-PT-3). NTIS $3.75.

Work done under a program to demonstrate feasibility of a supersonic mixing laser using chain reactions of the H_2-Cl_2 system to produce vibrationally excited HCl is described. The report describes both df and HCl laser experiments to determine the cause of low HCl power formerly observed. A factor of 50 improvement in power was obtained with a peak of 0.93 W cw. Chain lasing occurred at a cavity pressure as high as 25 torr on transitions P2(7) through P2(10). Further improvement in the power is limited by collisional deactivation, primarily that due to Cl atoms. (auth)

11125 (AD-782983) STUDY OF THE GAIN-DEPENDENT REFRACTIVE INDEX OF A CO_2 LASER. Honeycutt, T. E. (Army Missile Command, Redstone Arsenal, Ala. (USA)). Jun 1974. 151p. (RR-74-4). NTIS $5.00.

Results of research directed toward the achievement of a better understanding of the gain-dependent index of refraction of an active CO_2 laser medium are presented. Experimentally discovered frequency jumping and gain discontinuity effects in a 3-mirror laser have been studied using a newly developed mathematical model in which it was assumed that there was present a gain-dependent portion of the refractive index of the laser medium. The analytical results are related to the experimental results obtained from a long, 3-mirror, frequency-modulated CO_2 laser cavity. It was found that the simple model predicts, qualitatively, the experimental results. Specific results indicate that frequency pushing is the dominant interaction process in a reflective type coupled-cavity laser, and that this process is more dependent upon the direction in which the laser frequency is swept than it is upon the location of the pertinent mode frequencies relative to the line center frequency. (auth)

11126 (AD-783179) FAR INFRARED OPTICAL ELECTRONICS AND LASER RADIATION MODULATION. Annual Report, 1 February 1973–31 January 1974. Coleman, P. D. (Illinois Univ., Urbana (USA). Dept. of Computer Science). 1 Mar 1974. 81p. (UILU-ENG-74-2543; AFOSR-TR-74-0744). NTIS $4.00.

Research done on far IR integrated optics and frequency tunable coherent sources is described. The integrated optics studies are being performed in crystalline quartz dielectric waveguides using a cw optically pumped CH_3F molecular laser operating at 496 micrometers. Particular problems being studied at this time are waveguide couplers and the characteristics of single mode operation. Discrete frequency tuning in the 70 to 5,000 micrometer range is being obtained by mixing selected CO_2 laser lines in a GaAs dielectric waveguide. A second frequency tunable source using a simultaneous Raman and infrared active mode in GaAs is being studied to generate multi-kW tunable power in the 11 to 12 micrometer range and 1 to 10 W power in the 10 to 400 micrometer region. (auth)

11127 (AD-783218) RAM AIRBREATHING LASER. Final Report, 15 May–15 October 1973. Brunner, M. J. (General Electric Co., Philadelphia, PA. (USA)). May 1974. Contract F33615-73-C-4149. 90p. (ARL-74-0036). NTIS $4.00.

The performance characteristics of a ram airbreathing laser (RAL) were investigated for a wide range of Mach numbers (3 to 6) and altitudes (40 to 100 kft). The supersonic inlet, based on pressure recovery data, provided pressures between 2 and 55 atm and temperatures between 600 and 1700°K at the combustor inlet. Benzene was used as fuel to raise the gas temperature. The population inversion, the small signal gain and maximum available laser energy were determined as functions of axial position for the nonequilibrium flow through the special nozzle and laser cavity section for the unique RAL $CO_2-N_2-H_2O-O_2$ gas mixture for the current vibrational relaxation rates. The mole fraction of each constituent in the gas mixture was evaluated as a function of the combustor inlet conditions, fuel and fuel-air ratio. The laser performance characteristics were established for a wide variety of pressures, temperatures and nozzle characteristics. The pressure, temperature, nozzle area ratio and throat height for maximum laser performance were identified. The laser power increases with decreasing altitude and increasing mach number. The laser cavity and ram inlet geometries have been evaluated as functions of Mach number. (auth)

11128 (AD-783298) AERODYNAMIC WINDOW PERFORMANCE AND OPTICAL QUALITY. Cohen, L. S.; Kush, E. A.; Guile, R. N.; Flaherty, R. J. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). Feb 1974. Contract F44620-73-C-0031. 78p. NTIS $7.00.

The aerodynamic window is a viable means of exiting the high-power beam from a low-pressure laser cavity. It consists of a supersonic jet which spans an opening in the laser cavity wall sealing the cavity from ingestion of ambient air. The differential pressure force across the opening is balanced by a change in jet momentum while the beam passes through the aerodynamic window flow field transversely to the direction of flow of this jet. In evaluating the performance of the aerodynamic window the areas of primary concern are: (1) the ability of the aerodynamic window to transmit the laser beam with minimum beam degradation, (2) the amount of mass flow required to effect the aerodynamic seal, and (3) the effectiveness of the aerodynamic window in sealing the cavity from ingestion of ambient air. The technical investigation discussed is directed toward the first two areas of concern. (GRA)

11129 (AD-783445) ESTIMATE OF THE CHARACTERISTICS OF A GAS-DYNAMIC LASER. Generalov, N. A.; Kozlov, G. I.;

Selezneva, I. K. Translated by P. J. Reiff from Zh. Prikl. Mekh. Tekh. Fiz.; No. 5, 33-40(1972). 17p. (FTD-HT-23-696-74). NTIS $3.00.

The characteristics of a gasdynamic laser in a mixture of CO_2–N_2–He with a flat resonator are calculated. The system of equations describing the processes inside the resonator is analyzed and solved numerically. Inverse population of CO_2 laser levels is caused by the preliminary expansion of the given mixture through a flat hyperbolic nozzle. The dependences of output power on the coefficients of mirror reflection, resonator length, pressure, and composition of the working gas mixture are obtained. (GRA)

11130 (AD-783514) OPTICAL ISOLATION AND THE DESIGN OF LARGE APERTURE, HIGH EXTINCTION RATIO FARADAY ROTATORS FOR HIGH POWER GLASS LASERS. Final Report. Barr, O. C. (Naval Research Lab., Washington, D. C. (USA); USAEC, Washington, D. C.). Jun 1974. 68p. (NRL-MR-2817). NTIS $3.75.

A simple, high performance, low cost Faraday rotation of 8 cm aperture and 36 db isolation has been designed and constructed. Two of these rotators have been incorporated into the high-power glass laser at the U. S. Naval Research Laboratory (NRL). Design considerations, constuction details, and system integration aspects are discussed. (auth)

11131 (AD-783671) DESIGN OF FANNED AND WEDGED STACKED PLATE POLARIZERS FOR HIGH POWER LASERS. Final Report. Barr, O. C.; McMahon, J. M. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 38p. (NRL-MR-2830). NTIS $3.25.

A large aperture, low loss, high damage threshold polarizer design has been developed to meet the requirements arising in isolation of large glass laser systems. The design differs from traditional designs to achieve desired rejection ratios with fewer plates and lower transmission losses. Polarizers of this design have been fabricated, tested and installed in the high power glass laser at the Naval Research Laboratory. (auth)

11132 (AD-783706) RESEARCH ON HCl CHEMICAL LASER. Letter Report, 15 April–15 July 1974. Hall, R. J.; Meinzer, R. A.; Steele, R. V. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). 25 Jul 1974. Contract N00014-74-C-0377. 5p. NTIS $3.00.

Research efforts and results are summarized for an investigation whose objectives are to characterize the reaction mechanism of the cw combustion-driven chain-reaction HCl laser, select an optimum set of operating conditions, demonstrate the magnitude of the specific power which can be experimentally achieved, and predict the performance potential of the HCl laser at high cavity static pressures. These objectives are being pursued by making analytical calculations and experimental measurements. A computer program, CHEMIX, is being used to model the performance of the chain-reaction laser and the validity of these computations is being investigated by making comparisons with the results of chemiluminescent emission spectroscopy and optical power measurements. (GRA)

11133 (AD-783711) INVESTIGATION OF THE LONG TERM FREQUENCY STABILITY OF STABLE LASER STRUCTURES. Final Report. Hochuli, U. E.; Haldemann, P.; Li, H. A. (Maryland Univ., College Park (USA)). Aug 1974. Contract N00014-67-A-0239-0016. 23p. NTIS $4.25.

6328A He–Ne laser structures, made from ultralow expansion materials, suspended in temperature and pressure controlled chambers, have shown drift rates in excess of +5 MHz per day. The same structure, evacuated and used as passive Fabry Perot resonators, suspended in the previous now evacuated chambers, still show a drift rate of the order of +2 MHz per day. Computer simulated mirror model ageing shows that relatively large changes of the dielectric constants of the mirror coatings are needed to explain the measured drift. It is proposed that the dimensional stability of the materials, the properties of the optical contacts used as well as the behavior of the dielectric mirrors should be more carefully investigated. (auth)

11134 (AD-783842) Nd-DOPED MIXED CRYSTAL LASER MATERIAL RESEARCH. Final Report, 1 July 1972–31 March 1974. Holton, W. C.; Bellavance, D. W.; Bruni, F. J.; Dewit, M.; Watts, R. K. (Texas Instruments, Inc., Dallas (USA); Air Force Materials Lab., Wright-Patterson AFB, Ohio (USA)). Jul 1974. Contract F33615-72-C-1977. 106p. (AFML-TR-74-126). NTIS $4.50.

The mixed crystal system $Y_3(Al\ (x)\ Ga\ (1-x)\ 5012$ was investigated at a laser host material for Nd (3+). Spectroscopic studies established that at the optimum composition a reduction by a factor of 3 in gain, as compared with YAlG ($Y_3Al5012$), is possible, and implied increased output energy in Q-switched operation. Mechanical and thermal properties were found to be similar to those of YAlG. Laser rods were fabricated from boules of the material, examined for optical quality, and tested under Q-switched conditions. It is concluded that although the mixed crystal material has potential advantages, it is not possible to realize this potential because of the difficulty of growing crystals of high optical quality. (auth)

11135 (AD-783852) AIR FORCE WEAPONS LABORATORY LASER WINDOW TEST APPARATUS. Final Report, June 1972–June 1973. Dueweke, P. W.; Preonas, D. D.; Peterson, D. G. Jr. (Dayton Univ., Ohio (USA). Research Inst.; Air Force Weapons Lab., Kirtland AFB, N. Mex. (USA)). Jun 1974. Contract F29601-72-C-0122. 144p. (AFWL-TR-73-181). NTIS $4.75.

The laser window test apparatus (LWTA) evaluates windows and other optical components for high-power infrared laser systems. Specimens are probed with narrow beams from low-power lasers (currently CO_2 lasers) to determine their optical characteristics at incidence angles between 2 and 76 degrees from the normal. The instrument includes a photometer that uses digitized ratiometric detection for measuring single-pass transmittance and single-pass reflectance; an interferometer for measuring the optical pathlength through specimens; a rastering machine for moving the specimens in relation to the probing beams; and a minicomputer controls measurements, performs on-line calibrations, computes running statistical records of the acquired data, and generates an output tape of all data for use by a CDC-6600 computer program which generates the data in its final form and accuracy. (auth)

11136 (AD-783864) ANALYTICAL INVESTIGATION OF TRANSIENT DIFFUSER WAVE PHENOMENA. Aanerud, K. D. (Naval Postgraduate School, Monterey, Calif. (USA)). Jun 1974. 76p. NTIS $7.00.

Thesis.

A computer program was developed to solve the quasi-one-dimensional, unsteady flow problem associated with starting phenomena in various nozzle-short diffuser combinations of interest to gas dynamic lasers. The program was based on the techniques developed by George Rudinger in his book, "Wave Diagrams For Nonsteady Flow in Ducts." The techniques were modified to facilitate a fixed grid for computational ease. The program was used to analyze the starting transients of a Mach 3 nozzle with a semi-wedge diffuser. Results indicated that for a given inlet/exhaust pressure ratio, diffuser starts could be obtained at higher ramp angles for thin diffusers than for thick diffusers. (auth)

11137 (AD-784286) INVESTIGATION OF MOLECULAR AND CHEMICAL LASER SYSTEMS. Final Report, 4 January 1973–3 January 1974. Wolga, G. J.; McFarlane, R. A. (Cornell Univ., Ithaca, N. Y. (USA). Lab. of Plasma Studies; Army Missile Command, Redstone Arsenal, Ala. (USA)). Mar 1974. Contract DAAH01-73-C-0336. 63p. (RK-CR-74-4). NTIS $3.75.

Results of studies conducted in two research areas are reported. Experimental studies aimed at developing a cw atomic I laser at 1.315 micrometers explored several excitation mechanisms that lead to the production of the excited state of I(doublet $P(^1/_2)$. These included electronic energy transfer from electronically excited O_2 (singlet delta (G)), and chemical reactions such as O + H II yielding OH + I that produce doublet $P(^1/_2)$ directly. Preliminary evidence that E to V transfer behavior O_2 (singlet delta (G)) and hydrogen halide molecules occurs is presented. A second study of new systems suitable for optical pumping in the infrared combined theoretical prediction of several suitable systems of laser source and molecule to be pumped, with experimental verification of optical pumping. The results lead to the recognition that absorption on a combination band is not a suitable optical pumping scheme in the usual case. (auth)

11138 (AD-784296) LASER STUDIES IN $In_{1-x}Ga_xP$, $InAs_xP_{1-x}$, $In_xGa_{1-x}As$ AND RELATED III–V COMPOUNDS. Final Report, 10 November 1971–9 April 1974. Holonyak, N. Jr. (Illinois Univ., Urbana (USA). Materials Research Lab.). May 1974. Contract DAAK02-72-C-0076. 108p. (UILU-ENG-74-2546). NTIS $8.50.

Constant-temperature liquid phase epitaxy (CT-IPE) has been used to synthesize laser-quality $In_xGa_{1-x}As$, $In_{1-x}As_xP$, $In_{1-x}Ga_xP$, and $In_{1-x}Ga_xAs_yP_{1-y}$. Zinc-diffused junctions in CT-LPE InGaAs operate (pulsed) to temperatures as high as 265°K, and with further development would operate perhaps to 300°K. The sequential CT-LPE growth of an N-type layer of $In_{1-x}Ga_xP$ ($x \approx 0.63$), on a lattice matched $GaAs_{1-y}P_y$ ($y \approx 0.25$) substrate, followed by the growth of a similar P-type layer has provided the first junction laser to operate in the yellow (about 5900 Å). The structure approximates in behavior a single heterojunction, and IF duplicated in InGaAs, would doubtless lead to a 300°K laser at about one micrometer or longer wavelength. Most of this work is described in detail

in a series of appendices as well as various detailed features of InGaP. Also described is a plasma electron beam device for exciting laser operation in homogeneous samples. (auth)

11139 (AD-784303) ATMOSPHERIC PRESSURE GAS LASERS. Semiannual Technical Report, 1 December 1973–31 May 1974. Haus, H. A. (Massachusetts Inst. of Tech., Cambridge (USA); Army Research Office, Durham, N. C. (USA)). Aug 1974. Contract DAHC04-72-C-0044. 109p. NTIS $4.50.

The work for this research contract on atmospheric-pressure gas lasers had as its main objectives the generation of short laser pulses through mode locking and cavity dumping, the study of the nonlinear amplification processes in a transversely excited atmospheric pressure laser, and development of computer programs to check the observed amplifier responses against models of the relaxation processes of the CO_2 molecule in a laser discharge. (GRA)

11140 (AD-784326) LOW LOSS WINDOW MATERIALS FOR CHEMICAL LASERS. Semiannual Technical Report, 9 January–9 July 1974. Harrington, J. A. (Army Missile Command, Redstone Arsenal, Ala. (USA)). Jul 1974. 28p. (UAH-RR-154). NTIS $4.50.

The main objective of this research program is to study the optical properties of materials suitable for use as low loss chemical laser windows. In order to investigate various candidate materials, measurements will be made of the optical absorption coefficient at DF (3.8 microns) and HF (2.7 microns) frequencies using chemical laser calorimetry. In conjunction with the absorption measurements, chemical polishing techniques will be developed and applied to some materials to minimize surface absorption. Successful polishes were developed for CaF_2 and BaF_2 but no successful polish was found for SrF_2. Application of the polishes should not only help reduce surface absorption but also minimize laser-induced surface damage from high powered lasers. Chemical laser calorimetry was successfully carried out at HF frequencies on two polytran alkaline earth fluoride samples. The results for the absorption coefficient are compared to those obtained from spectral emittance and CO laser calorimetry measurements. The higher values of the absorption coefficient obtained by HF laser calorimetry as compared to the values obtained by the other two methods are believed to be due to absorption by water bands on the surface or to OH ions in the crystals. (auth)

11141 (AD-784500) E-BEAM HCl LASER. Final Technical Report. Shirley, J. A.; Hall, R. J.; Bronfin, B. R. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). 30 Aug 1974. 58p. NTIS $3.75.

The feasibility of producing stimulated emission in the 3 to 5 micrometer wavelength band by direct electron impact excitation of hydrogen chloride vibrational levels was investigated theoretically and experimentally. Theoretical analysis predicts an optical gain coefficient in excess of 0.4%/cm. The importance of high electron density and low initial gas temperature is predicted. The results of electric discharge/laser experiments are described. Experiments have been conducted in 5% HCl/95% argon mixtures at P = 10 torr in the E-beam sustained discharge. These conditions were insufficient to demonstrate stimulated emission. (auth)

11142 (AD-784531) ANALYSIS OF CHEMICAL LASERS. Volume 1. Laser and Mixing Program (LAMP) Theory and User's Guide. Final Report, 20 September 1973–30 June 1974. Thoenes, J.; McDanal, A. J.; Ratliff, A. W.; Smith, S. D. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA); Army Missile Command, Redstone Arsenal, Ala. (USA)). Jun 1974. Contract DAAH01-74-C-0173. 154p. (LMSC-HREC-TR-D-390222-1). NTIS $5.00.

A laser and mixing program (LAMP) is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed inviscid laser cavity flows can be investigated as a special case of the more general analysis. This report contains a description of the analysis as well as a user's manual. (auth)

11143 (AD-784532) ANALYSIS OF CHEMICAL LASERS. Volume 2. Chemical Laser Flow Analyses. Final Report, 20 September 1973–30 June 1974. Mikatarian, R. R.; Kurzius, S. C.; McDanal, A. J.; Theones, J. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA); Army Missile Command, Redstone Arsenal, Ala. (USA)). Jun 1974. Contract DAAH01-74-C-0173. 132p. (LMSC-HREC-TR-D-390222-2). NTIS $4.75.

The results of a study undertaken to compare theoretical calculations with experimental laser-type reactive flow data are discussed. The results of the study are most encouraging. The strong influence of nozzle boundary layers upon laser cavity properties is demonstrated as is the applicability of a two-equation (KW) turbulence model for describing the turbulent transport in laser cavity flows. The potential effects of finite rate turbulent eddy dissipation are discussed. An analytical investigation has been initiated on a TCL device designed by Rocketdyne in which CO_2 is injected into the preburner nozzle boundary layer. Interim results are presented showing the development of the nozzle boundary layer profiles. Results of a parametric study of a D_2–F_2 direct combustion laser device are presented. (auth)

11144 (AD-784533) ANALYSIS OF CHEMICAL LASERS. Volume 3. One-Dimensional Laser and Mixing Program Guide. Final Report, 20 September 1973–30 June 1974. Ring, L. R.; Mikatarian, R. R. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA); Army Missile Command, Redstone Arsenal, Ala. (USA)). Jun 1974. Contract DAAH01-74-C-0173. 77p. (LMSC-HREC-TR-D-390222-3). NTIS $4.00.

The one-dimensional laser and mixing program (ODLAMP) is described for analyzing multi-species lasing in a chemically reacting one-dimensional stream with mass addition. Mass is assumed to be injected (at a predescribed rate) from each of two separate streams, into a primary lasing stream. Lasing due to P-transitions (i.e., transitions proceeding from (V + 1, J – 1) to (V,J)) is treated. Both the analysis and computer programs are presented, including an input guide, sample calculation and flow chart. (auth)

11145 (AD-784534) ANALYSIS OF CHEMICAL LASERS. Volume 4. Method of Characteristics Laser and Mixing Program (MOC-LAMP) Theory and User's Guide. Final Report, 20 September 1973–30 June 1974. Ratliff, A. W.; Thoenes, J.; Smith, S. D. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA); Army Missile Command, Redstone Arsenal, Ala (USA)). Jun 1974. Contract DAAH01-74-C-0173. 93p. (LMSC-HREC-TR-D-390222-4; RK-CR-74-13-VOL-4). NTIS $4.00.

A laser and mixing computer program is described which considers the coupling between gasdynamic properties, cavity characteristics, and resulting laser radiation for diffusion-type chemical laser oscillator cavities. The formulation assumes non-uniform mixing with lateral pressure gradients and lasing due to multiple transitions between the various excited levels of the lasing molecule. Excitation of the active medium traversing a Fabry-Perot optical cavity is caused by highly exothermic reactions between gradually mixing reactants discharged from a grid nozzle. Uniform, premixed inviscid laser cavity flows can be investigated as a special case of the more general analysis. (auth)

11146 (AD-784548) ANALYSIS OF CHEMICAL LASERS. Volume 5. Rotational Relaxation Effects. Final Report, 20 September 1973–30 June 1974. Thoenes, J. (Lockheed Missiles and Space Co., Huntsville, Ala. (USA); Army Missile Command, Redstone Arsenal, Ala. (USA)). Jun 1974. Contract DAAH01-74-C-0173. 37p. (LMSC-HREC-TR-D-390222-5). NTIS $3.25.

The previously developed laser and mixing program (LAMP) theory is extended to explicitly include rotational relaxation effects. The theory considers the coupling between gasdynamic properties, cavity characteristics, and laser radiation for diffusion-type chemical laser oscillators. The formulation assumes parallel mixing and constant lateral pressure with lasing due to single or multiple transitions between certain vibrational/rotational molecular energy levels. (auth)

11147 (AD-903811) MODULARIZED FIBER-OPTIC-COUPLED LASER ARRAYS. Quarterly Progress Report No. 1. Doerbeck, F. H.; Carr, D. L. (Texas Instruments, Inc., Dallas (USA)). Apr 1972. DAAK02-72-C-0173. 38p. (TI-03-72-50). NTIS $5.00.

Equipment was built to align fiber optical ribbons in front of the emitting facet of close-confinement lasers. Typically, 70% of the laser power was transmitted through the fiber with an air gap between laser and fiber; approximately 100% was obtained when the gap was filled with an epoxy. Beam-angle data are presented, indicating that a power loss of 30% should be expected for a beam angle of 15° cone half-angle (an aperture of f/1.8). First LOC lasers emit into a cone angle too wide (60 to 90 deg) for array applications. (GRA)

11148 (SAND-74-5529) OBSERVATION OF LASER ACTION IN CO GAS EXCITED ONLY WITH A NUCLEAR REACTOR. McArthur, D. A.; Tollefsrud, P. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 2p. (CONF-741048-2). Dep. NTIS $4.00.

From 4th conference on chemistry and molecular lasers; St. Louis, Missouri, USA (Oct 1974).

Lasing was observed in a CO laser apparatus excited by an intense burst of fission fragments. The laser apparatus for the experiment was mounted so that its axis was about 20 cm from the axis of the SPR-II reactor at Sandia Laboratories. This reactor produced a fast neutron flux $\sim 5 \times 10^{11}$ n/cm^2-sec at the apparatus, in a pulse ~60 μsec wide. The laser apparatus consisted of a vertically-oriented cylinder divided into two chambers by a CaF_2 Brewster window. The lower chamber, immersed in liquid nitrogen, contained the laser gas (pure CO at ≈100 torr at 77°K), and a 20 cm long cylinder coated with enriched $^{235}U_3O_8$. The neutrons, partially moderated, caused fission fragments to emerge from the coating and excite the laser gas. A laser output mirror (reflectance = 96 or 98.5%) was mounted at the top of the upper chamber, while a totally reflecting mirror was mounted at the bottom of the lower chamber. The upper chamber was evacuated to provide insulation for the cold Brewster window. The laser output beam was focussed by a mirror system onto a calorimeter and Ge:Au detector located about 15 meters away, beyond the reactor shielding. When the laser mirrors were aligned, a laser signal pulse about 1000 times larger than the background was observed in the Ge:Au detector. The signal peaked near the fast neutron pulse peak, and turned on and off rapidly as though a sharp threshold were being crossed. This signal disappeared if the CO was replaced by pure N_2, or if the output mirror was deliberately misaligned. The signal passed through a narrow-band interference filter centered at 5.24 μ, indicating lasing on the vibrational bands of CO. The measured laser pulse energy ($\sim 3 \times 10^{-4}$ J) was ten times larger than could possibly be explained by fluorescence from the gas. (TFD)

11149 (UCID-16608) MODEL LC-13 LASER CALORIMETERS USING COMMERCIAL THERMOELECTRIC MODULES. Gunn, S. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Oct 1974. Contract W-7405-eng-48. 10p. Dep. NTIS $4.00.

Twin-disk laser calorimeters using semiconductor thermoelectric modules are described. Comparisons with a previous type indicate agreement within 1%. The new type is simpler and more economical to construct. (auth)

11150 (UCRL-75917) APPLICATIONS OF NON-UNIFORM POCKELS CELLS TO HIGH POWER LASER AMPLIFIERS. Simmons, W. W.; Johnson, B. C.; Glass, A. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Oct 1974. 10p. (CONF-741211-1). Dep. NTIS $4.00.

From international meeting on electron devices; Washington, District of Columbia, USA (9 Dec 1974).

Fast KDP Pockels cells may be designed such that the electric field distribution within the crystal is non-uniform. In this case, amplitude transmission of the cell becomes a function of transverse spatial coordinates. Design parameters, predicted performance curves, and certain experimental results for circular aperture KDP cells, based on specialized, detailed control of V(x,y,t) are presented. These cells are intended to serve the following functions: (1) beam profiling (apodization); (2) temporal pulse shaping; and (3) whole-beam self-focusing compensation. Each of these functions has direct application to the performance of large, high power Nd:glass laser amplifiers, which are currently under intensive development for laser fusion. (auth)

11151 LASER SYSTEM EMPLOYING STIMULATED MULTIPLE-PHOTON EMISSION PROCESS. Rhodes, C. K. (to United States Atomic Energy Commission). US Patent 3,846,709. 5 Nov 1974. Filed date 9 Feb 1973. 4p.

A laser system which employs a stimulated multiple-photon emission process to produce pulsed outputs of high energy, narrow pulsewidth, and short wavelength, particularly useful in controlled fusion applications is described. The system basically comprises an oscillator which produces a desired narrow pulse at frequency w which is transmitted to an amplifier through a frequency shifter which converts a fraction of the pulse to a pulse at the required frequency $\omega_{3/2}$, which is subsequently amplified by stimulated two-photon emission. (Official Gazette)

11152 RECIRCULATING LIQUID-NITROGEN-COOLANT SYSTEM FOR SOLID-STATE LASERS. Solin, S. A.; Doehler, J. (to United States Atomic Energy Commission). US Patent 3,851,274. 26 Nov 1974. Filed date 29 Jun 1973. 12p.

A recirculating liquid-nitrogen-coolant system for solid-state lasers permits prolonged continuous operation of the laser at liquid-nitrogen temperatures without boiling the liquid-nitrogen in contact with the laser rod. A liquid-coolant pump, submerged beneath the surface of liquid-nitrogen contained within a Dewar vessel at atmospheric pressure, pumps liquid-nitrogen at an increased pressure through a heat exchanger, similarly submerged within the liquid-nitrogen at atmospheric pressure, to a laser head supporting a solid laser rod. The pressurized liquid-nitrogen, which has been cooled below its effective boiling point in passing through the heat exchanger, passes over the surface of the solid laser rod and absorbs heat from the laser rod without the liquid-nitrogen's temperature being raised above the increased effective boiling temperature, thereby precluding boiling of the liquid-nitrogen. The liquid nitrogen exits from the laser head and is returned to the Dewar vessel for recirculation. Recirculation of the liquid-nitrogen from the Dewar vessel through the laser head permits continuous cooling of the laser during prolonged and continuous operation. (Official Gazette)

11153 DYE LASERS. Schaefer, F. P. (ed.). New York; Springer-Verlag 294p. $25.10.

Information on dye lasers is presented in five parts done by five different authors. The parts include: Principles of Dye Laser Operation; Continuous-Wave Dye Lasers; Mode-Locking Dye Lasers; Structure and Properties of Laser Dyes; and Applications of Dye Lasers. The treatment, being tutorial in nature, is suitable both for graduate students and for scientists working in the dye-laser field or applying a dye laser in another research discipline. The literature is reviewed up to Spring 1973, and a list of additional references extends to Summer 1973. (TFD)

11154 CHEMILUMINESCENCE AND BIOLUMINESCENCE. Second International Conference Held at Athens, Georgia, October 10–13, 1972. Cormier, M. J.; Hercules, D. M.; Lee, J. New York; Plenum Publishing Corporation (1973). 528p. (CONF-7210126-). $28.00.

An abstract for one of the papers presented has been prepared. The remaining papers were not in scope for NSA. (TFD)

For an abstract of an individual paper see: 11155.

11155 CHEMICAL LASERS PRODUCED FROM O(^{3}P) ATOM REACTIONS. II. A Mechanistic Study of 5-μm, CO Laser Emission from the O + C_2H_2 Reaction. Lin, M. C. (Naval Research Lab., Washington, DC). pp 61-71 of Chemiluminescence and Bioluminescence. Cromier, M. J.; Herculs, D. M.; Lee, J. (eds.). New York; Plenum Publishing Corp. (1973).

From second international conference on chemiluminescence; Athens, Georgia, USA (10 Oct 1972). See CONF-7210126-.

CO laser emission at 5 μm was observed from both O + C2H_2 and O + CH_2 reactions. Product analysis and detailed study of the effects of pressure and inhibition by O_2 and C_2H_2 lead to the conclusion that the stimulated emission observed in these systems is primarily a consequence of the O + CH_2 reaction. Based on the results of frequency analysis, it is concluded that the O + CH reaction is unimportant under the present conditions. (auth)

11156 Q SWITCHING AND MODE LOCKING OF CO_2 LASER WITH AROMATIC HALOGENATED HYDROCARBONS. Izatt, J. R.; Caudle, G. F.; Bean, B. L. (Univ. Laval, Quebec). Appl. Phys. Lett.; 25: No. 8, 446-448(15 Oct 1974).

Passive Q switching of the CO_2 laser by a new class of saturable absorbers is reported. Results are presented for eight representatives of this class: benzene, chlorobenzene, bromobenzene, m-dichlorobenzene o-dichlorobenzene, m-difluorobenzene, pentafluorobenzene, and hexafluorobenzene. These Q-switching agents operate on a large number of lines in both the 9.6- and 10.6-μ bands. Other aromatic halogens selected on the basis of their absorption spectra are expected to display similar Q-switch characteristics. This new class of saturable absorbers provides increased flexibility in the production of CO_2 laser pulses. (auth)

11157 InAs SPIN-FLIP LASER OPERATION OF 3 μm. Eng, R. S.; Mooradian, A.; Fetterman, H. R. (Massachusetts Inst. of Tech., Lexington). Appl. Phys. Lett.; 25: No. 8, 453-454(15 Oct 1974).

Stimulated spin-flip Raman scattering in InAs has been achieved using an HF laser pump near the band-gap resonance. Thresholds were determined to be less than 20 W and conversion efficiency is estimated to be in excess of 20%. (auth)

11158 ELECTRON ENERGY DISTRIBUTION AND EXCITATION RATE CALCULATION IN A DISCHARGE IN CO–He SYSTEM. Wu, F. T. (Comarco Inc., Ridgecrest, CA); Yu, W. M.; Lundstrom, E. A. Appl. Phys. Lett.; 25: No. 8, 463-464(15 Oct 1974).

The electron energy distribution function has been numerically determined from the Boltzmann equation for some typical discharge conditions in CO and its mixtures. Collisions of the second kind have also been incorporated in the equation and it is found

that the consideration of the second kind of collisions is important when the upper states are highly excited. This is, indeed, the case for the laser active medium. (auth)

11159 MODE LOCKING OF A TEA CO LASER. Nurmikko, A. V. (Massachusetts Inst. of Tech., Cambridge). Appl. Phys. Lett.; 25: No. 8, 465-466(15 Oct 1974).

Forced mode locking of a TEA CO laser has been achieved on a number of vibrational-rotational transitions. Peak powers have been measured in excess of 1 kW with detector-limited pulsewidths in the nanosecond regime. (auth)

11160 MODULAR DISC LASER. Tanner, R. L. (to United States Atomic Energy Commission). US Patent 3,851,267. 26 Nov 1974. Filed Date 18 Oct 1972. 6p.

A disc laser amplifier system comprising a plurality of modules designed around individual discs of laser glass is described. Each module represents an individual amplifier unit and contains a disc of laser material, a disc holder, helical lamps for pumping the disc, means for cooling the lamps, and appropriate reflectors. The disc holder is mounted to the ends of the module to prevent interference with the optical pumping and to allow easy rotation of the disc to achieve a desired polarization. (9 Claims, 8 Drawing Figures) (Official Gazette)

11161 GENERATION OF MULTIBAND 1-ns PULSES IN CO_2 LASERS. Figueira, J. R.; Sutphin, H. D. (Los Alamos Scientific Lab., NM). Appl. Phys. Lett.; 25: No. 11, 661-663(1 Dec 1974).

A technique of generating 1-ns pulses of CO_2 laser radiation using a CdTe electro-optic gate driven by a laser-triggered Blumlein structure is described. By the use of intercavity absorbers, simultaneous output is obtained on multiple rotational lines of both the 9.4- and 10.4-μm vibrational bands. (auth)

11162 IMPROVED PERFORMANCE OF A DOUBLE DISCHARGE INITIATED PULSED HF CHEMICAL LASER. Voignier, F.; Gastaud, M. (Compagnie Generale d'Electricite, Marcoussis, France). Appl. Phys. Lett.; 25: No. 11, 649-650(1 Dec 1974).

Operation of a pulsed HF chemical laser initiated by electric discharge is reported. Uniform transverse capacitive discharge through high-pressure mixtures of SF_6 and H_2 is effected by the use of a double discharge. For the mixture SF_6, H_2, He (250, 20, and 280 torr, respectively) laser output of more than 1 J per pulse with 4% electrical efficiency from an active volume of 0.06 liter has been achieved. Pulse shapes of the different transitions, spectrum measurements, and SF_6 decomposition rate are reported. (auth)

11163 PROPAGATION OF A HIGH-INTENSITY LASER PULSE WITH SMALL-SCALE INTENSITY MODULATION. Bliss, E. S.; Speck, D. R.; Holzrichter, J. F.; Erkkila, J. H.; Glass, A. J. (Univ. of California, Livermore). Appl. Phys. Lett.; 25: No. 8, 448-450(15 Oct 1974).

For laser beams of large aperture with power far above the critical power for self-focusing, nonlinear propagation instabilities lead to the growth of small-scale variations in intensity and phase. Measurements of the growth rate for interference fringes in unpumped ED-2 laser glass as a function of fringe spacing and intensity are reported. Calculations based on the simplest form of linearized small-scale instability theory agree approximately with the measured rates, and a more complete linearized treatment predicts the growth rates within experimental error. (auth)

11164 CHEMICAL AND BIOCHEMICAL APPLICATIONS OF LASERS. Volume I. Moore, C. B. New York; Academic Press, Inc. (1974). 406p.

The primary purpose of this book is to encourage chemists, biochemists, and chemical physicists to apply lasers in new areas. A number of lasers and laser systems have been developed to the point of being valuable tools in chemical research, and the development of new lasers and their application to problems in chemistry and biochemistry continue at an increasingly rapid pace. This volume gives researchers and graduate students a general introduction to the successful application of lasers in many areas. The detailed descriptions of some applications serve as valuable reviews for specialists and as convincing documentation of the value of lasers for general readers. The first chapter is a general introduction to the fundamental physics of lasers and to the properties of practical laser systems. It provides much of the information needed to evaluate the feasibility of new applications of lasers. The succeeding chapters describe the application of lasers to individual areas in spectroscopy, in the dynamics of small molecules, and in the kinetics of biochemical systems. Each chapter begins with an introduction of general interest to all readers. This volume and those that follow are uniquely valuable to chemical and biochemical researchers, in that they discuss applications of lasers in many areas of chemistry and biochemistry, rather than being devoted to laser physics or to a particular chemical speciality. (auth)

11165 ELECTROIONIZATION CO_2 LASER WITH A RADIATION ENERGY OF 2.5 J IN A PULSE. Bychkov, Yu. I.; Konovalov, I. N.; Kurbatov, Yu. A.; Orlovskii, V. M. (Inst. of Atmospheric Optics, Tomsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 817-819(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 165-167(1974).

The construction and energy characteristics of a pulsed laser based on the gas mixture $CO_2 + N_2 + He$ are described. The pressure range is up to 3 atm, the power is ~2 MW, the pulse energy is 2.5 J at an efficiency of up to 10%. The optimal concentration of the gas mixture is found. It is shown that an admixture of He has a substantial effect on the laser efficiency. (auth)

11166 OPTIMIZING THE PARAMETERS OF A DYNAMIC AQUEOUS CO_2 LASER. Zharkov, V. D.; Lapushonok, L. Yu.; Chebykin, N. N. Zh. Prikl. Mekh. Tekh. Fiz.; No. 5, 3-8(1974). (In Russian).

In order to obtain the maximum possible amplification coefficient for a CO_2-N_2-Ne, dynamic gas laser a joint optimization of parameters was carried out for drag, component concentrations and parameters determining the form of the jet (quasi one-dimensional model of flow). The optimal parameters were determined as a function of the limitations on flow drag temperature and the dimensions of the critical cross-section. (SJR)

11167 EVOLUTION OF LASING IN A LASER WITH A BLEACHING-DYE FILTER. Korniyenko, L. S.; Kravtsov, N. V.; Naumkin, N. I. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 18: No. 12, 1868-1871(Dec 1973).

Translated from Radiotekh. Elektron.; 18: No. 12, 2554-2557 (Dec 1973).

The lasing evolution process in a ruby laser with a bleaching-dye filter was investigated experimentally. It is shown that the "previous history" is uniquely related to the radiation pulse shape and that with the appearance of self-locking the laser radiation already has a quasi-periodic fluctuation pattern when the filter starts to bleach. The experimental results obtained agree qualitatively with theory. (auth)

11168 LASER AND METHOD OF MAKING SAME. Gottsman, H.; Specovius, J. (to Licentia Patent-Verwaltungs GmbH). US Patent 3,849,790. 19 Nov 1974. Priority date 29 Jul 1971, F.R. Germany. 10p.

The semiconductor laser is in the form of a diode, preferably a heterostructural diode. The diode includes a light-emitting active region. A layer of one conductivity type is disposed at a small distance from the light-emitting active region. Means are provided adjacent the layer of one conductivity type to block current flow through laterally extending portions of the layer for confining the current to a narrow path through the layer. The method of making the semiconductor laser includes applying a mask to the surface of the semiconductor layer of the one conductivity type, the mask corresponding to the lateral outline of the current-conducting path to be formed. Thereafter, either the exposed portions of the surface are removed by etching or doping material is diffused into the layer of one conductive type through the exposed portions of the surface to produce regions therein of opposite conductivity type. (Official Gazette)

11169 LASER GLASS HOST COMPOSITIONS COMPRISING TeO_2, PbO, ZnO. Cooley, R. F. (to Owens-Illinois Inc.). US Patent 3,849,739. 19 Nov 1974. Filed date 27 Jun 1973. 8p.

Laser glass host compositions for effective lasing amounts of Nd_2O_3 are disclosed, the host compositions comprising TeO_2, PbO and ZnO in certain molar amounts. Methods of making highly efficient laser articles, including laser rods, also are disclosed. The new use of the above-described TeO_2/PbO/ZnO glass compositions for forming laser articles are disclosed. The new use includes forming laser articles from the glasses; pumping the laser articles to provide an energy inversion; and lasing the pumped articles. (Official Gazette)

11170 MULTILAYER ANTIREFLECTION COATINGS FOR SOLID STATE LASERS. Hakki, B. W. (to Bell Telephone Labs., Inc.). US Patent 3,849,738. 19 Nov 1974. Filed date 5 Apr 1973. 6p.

A solid state laser is provided with at least one mirror surface with an antireflection coating comprising at least two contiguous layers, one of which has a refractive index greater than, and the other of which has a refractive index less than, the square root of

the refractive index of the active region of the laser. The AR coating is impedance matched to the active region by proper choice of the thicknesses of the layers. In a preferred embodiment the AR coating for an AlGaAs double heterostructure junction laser comprises an innermost layer of ZnS and an outermost layer of Al_2O_3. (Official Gazette)

11171 DETERMINATION OF THE LASING LOSSES IN SOLID-STATE CONTINUOUS-WAVE LASERS. Novokreshchenov, V. K.; Shkunov, N. V. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 2, 545-546(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 2, 207-208(1974).

A procedure for determining the losses in the resonator of a solid-state laser with allowance for the nonlinearity of the light response of the pumping lamp is described. (auth)

11172 LASING CHARACTERISTICS OF SEVENTEEN VISIBLE-WAVELENGTH DYES USING A COAXIAL-FLASHLAMP-PUMPED LASER. Marling, J. B.; Hawley, J. G.; Liston, E. M.; Grant, W. B. (Stanford Research Inst., Menlo Park, CA). Appl. Opt.; 13: No. 10, 2317-2320(Oct 1974).

The performance and tuning characteristic of organic dye lasers were measured using commercially available coaxial flashlamps as the pumping source. Tuning by a diffraction grating permitted continuous coverage of the 4200 to 7500-Å region at up to 0.6% tuned output energy efficiency. Preliminary results with a 600-J Marx-Bank coaxial laser at 4500 Å show 1% efficiency and single-pass unsaturated gain greater than 20 at 4500 Å. (auth)

11173 RADIOACTIVE PREIONIZATION METHOD AND APPARATUS FOR PULSED GAS LASERS. Berta, M. A.; Jones, C. R. (to Secretary of the Air Force). US Patent 3,842,284. 15 Oct 1974. Filed date 15 Dec 1972. 4p.

A radioactive preionization method and apparatus for pulsed gas lasers are described. Emissions from a radioactive isotope located within or around the gas-laser active volume are used to create a constant, uniform preionization in the laser gas and aid the formation of the main electrical discharge pulse. (Official Gazette)

11174 LENS DESIGN FOR LASER SYSTEMS. Sinclair, D. C. (Univ. of Rochester, NY). J. Opt. Soc. Amer.; 64: No. 3, 314-316 (Mar 1974).

Lenses for focusing laser beams can be designed by use of conventional methods, but since laser beams are monochromatic, and have angular divergences that are limited by diffraction, the requirements for an optimized design are different than those for an ordinary lens. In particular, in a weakly focused beam, the axial locations of the paraxial focus and the gaussian beam waist do not coincide. Although the focus shift is small for a beam of low f number, when the f number is as large as f/1000 (a common value in certain types of laser systems), the shift may be comparable to the focal length. Such a shift should be taken into account in an optimized focusing system, although the extremely large depth of focus obtained with a beam of such large f number makes the resultant image blur rather small. (auth)

11175 MEDIUM HOMOGENEITY CONSIDERATIONS IN LOW-MACH-NUMBER FLOW DISCHARGES. Jacob, J. H.; Legner, H. H.; Ahouse, D. R.; Wallace, J. (Avco Everett Research Lab., Inc., MA). Appl. Phys. Lett.; 25: No. 10, 542-544(15 Nov 1974).

Density variations in low-Mach-number (≤0.3) flowing discharges have been obtained by coupling the fluid mechanics with the plasma dynamics. The coupling occurs through the variation of the electrical conductivity with density. If this variation is known, for a particular lasing mixture, the simple and accurate analysis presented may be applied. (auth)

11176 MIRROR SUPPORT STRUCTURE FOR AN INTERNAL MIRROR-TYPE GAS LASER TUBE. Furuse, T.; Matsuoka, T.; Kato, K. (to Nippon Electric Co. Ltd.). US Patent 3,851,275. 26 Nov 1974. Priority date 7 Sep 1972, Japan. 6p.

A mirror support structure for an internal mirror-type gas laser tube includes a cylindrical metal member joined at one of its ends to the envelope of the laser tube. The peripheral end of the mirror is bonded to the other end of the cylindrical member with a low melting-point glass. (Official Gazette)

11177 FLASHLAMP DISCHARGE AND LASER EFFICIENCY. Dishington, R. H.; Hook, W. R.; Hilberg, R. P. (TRW Systems, Redondo Beach, CA). Appl. Opt.; 13: No. 10, 2300-2312(Oct 1974).

This paper presents an improvement in the method of calculating flashlamp performance and indicates how this can be used to evaluate the effect of flashlamp related system parameter changes on the efficiency of a solid state laser using such a flashlamp as a pump. It is shown that, in addition to being functions of the α and β constants in the well-known theory of Markiewicz, Emmett, and Holzrichter, the normalized peak current and pulse width are also functions of the input energy. Furthermore, the product of peak current and pulse width is indicated to be the most significant factor relating lamp input and output. Finally, a curve is given for the fluorescence pumping efficiency and scaling of laser input-output levels is discussed. (auth)

11178 GASEOUS LASER WITH CATHODE FORMING OPTICAL RESONATOR SUPPORT AND PLASMA TUBE ENVELOPE. Shull, W. A.; Barker, G. C. (to Coherent Radiation). US Patent 3,851,272. 26 Nov 1974. Filed Date 2 Jan 1973. 8p.

A gaseous laser is described wherein the cylindrical cathode is utilized to form the plasma tube envelope and wherein the cathode is also utilized as a support for the laser optical resonator. (Official Gazette)

11179 OPTICAL SPECTRA AND LASER ACTION IN Nd^{3+}-DOPED $CaY_2Mg_2Ge_3O_{12}$. Sharp, E. J. (Night Vision Lab., Fort Belvoir, VA); Miller, J. E.; Horowitz, D. J.; Linz, A.; Belruss, V. J. Appl. Phys.; 45: No. 11, 4974-4979(Nov 1974).

Crystals of the garnet-structured germanate $CaY_2Mg_2Ge_3O_{12}$ have been grown from a melt containing 6 mole % Nd^{3+}. The fluorescence, absorption, excitation spectra, lifetime, and linewidths have been measured and were compared with the results for Nd^{3+}:YAG. The important spectroscopic features of Nd^{3+}:$CaY_2Mg_2Ge_3O_{12}$ are a lifetime of 305 μsec, a strong absorption in the near infrared, a very intense fluorescence line at 941 nm, and a linewidth at this wavelength of approximately 37 cm^{-1}. Laser action has been achieved at 1058.96 nm at room temperature. An estimate of the laser transition cross section gives a value of $\sigma = 6 \times 10^{-20}$ cm^2. (auth)

11180 ROTATIONAL DIFFUSION AND TRIPLET STATE PROCESSES IN DYE LASER SOLUTIONS. Phillion, D. W.; Kuizenga, D. J.; Siegman, A. E. (Stanford Univ., CA). J. Chem. Phys.; 61: No. 9, 3828-3839(1 Nov 1974).

A cw dye laser with a rotatable intracavity Brewster-angle plate can be forced to oscillate with its signal polarization rotated by an arbitrary angle β about the laser axis from the pumping laser polarization. The threshold pump power $R(\beta)$ then increases as the signal polarization is rotated from parallel ($\beta = 0°$) to perpendicular ($\beta = 90°$). By measuring the ratio $R(90°)/R(0°)$ and comparing it with the first excited singlet level fluorescence intensity ratio $I(0°)/I(90°)$ measured in the same laser medium below threshold, it is possible to determine the important dye laser triplet state parameter $K_T \equiv k_{ST}\tau_T\sigma_T/\sigma_e$. A detailed analysis of this new triplet measurement method is given. Both the orientational distribution of the excited state population and the gain for arbitrary polarizations and pumping geometry are calculated. Triplet state effects have been studied for Rhodamine 6G as a function of dye and soap concentration in H_2O. The triplet state parameter K_T is found to have the value 0.35 ± 0.02 at 5960 Å for a 5×10^{-4} M concentration of R6G in water with 2% by volume of Triton X-100, and 0.25 ± 0.02 for the same dye concentration with 4% by volume of Ammonyx LO. The very long rotational relaxation times measured (~1 to 2 nsec) indicate rigid attachment of the R6G molecules to micelle soap complexes. Evidence of intermolecular energy transfer via dipolar coupling at higher dye concentrations is observed. (auth)

11181 OPTICAL-GAIN MEASUREMENTS IN A CW TRANSVERSE-DISCHARGE TRANSVERSE-GAS-FLOW CO_2 : N_2 : He planar-waveguide laser. McMullen, J. D.; Anderson, D. B.; Davis, R. L. (Rockwell International, Anaheim, CA). J. Appl. Phys.; 45: No. 11, 5084-5087(Nov 1974).

Optical-gain measurements are reported for a dc-excited planar-hollow-waveguide CO_2 : N_2 : He laser for which the gas flow and discharge current are collinear, and both are transverse to the optical axis of the waveguide. A spatially uniform thin-sheet glow discharge was demonstrated for gas pressures between 80 and 400 torr, using transverse dc excitation. The dependence of optical gain upon gas composition, gas pressure, discharge current, and wall temperature was characterized for a 1-mm-high planar hollow waveguide. Optimum gain was 4 dB/m at a pressure of 100 torr and a wall temperature of 233°K. (auth)

Cryogenic and Superconducting Equipment and Devices

11182 (AD-768626) SUPERCONDUCTING MAGNETOHYDRODYNAMIC MAGNET COMPREHENSIVE TESTING. Interim Technical Report, August 1972–April 1973. Stekly, Z. J. J.; Thome, R. J. (Magnetic Corp. of America, Waltham, Mass.). Sep 1973. Contract F33615-72-C-2069. 120p. (MCAD-27; AFAPL-TR-73-44). NTIS $8.00.

Extensive tests were performed on a lightweight, high current density superconducting MHD magnet. The system bore is 0.21 m in diameter and the uniform field length (5%) is 0.88 m. During

the tests, central and maximum fields of 3.9 and 5.46 Wb/m^2 respectively were attained at an overall winding current density of 1.2×10^8 A/m^2. Operating characteristics were studied while rapidly charging and discharging the coil (times of the order of minutes). Information on load distribution in the magnet structural components was generated using a system of strain gages with computer aided data reduction. Test results led to structural modifications which improved performance and suggest other areas where alterations may be desirable. (auth)

11183 (AD-781190) ISSUES IN HIGH-POWER CRYOGENIC TURBOGENERATOR. Dombrovskii, V. V.; Anempodistova, N. N.; Aleksandrova, L. P. 1 Apr 1974. Translated from pp 3-17 of Vysokoispol. Turbo. I Gidrogen. S. Neprosred. Okhlazhen., Leningrad, 1971. (FSTC-HT-23-1691-73). 21pp. NTIS $4.00.

Problems in designing high-power electric machines with low-temperature cooling of windings made of superconducting and pure metals are discussed. The project for a 1600 MW turbogenerator with superconducting rotor and stator winding made of beryllium and operating at 77°K is used as the design illustration. (GRA)

11184 (AD-781281) ULTRA-LOW-NOISE PREAMPLIFIER USING SUPERCONDUCTING QUANTUM DEVICES. Davidson, A.; Newbower, R. S.; Beasley, M. R. (Harvard Univ., Cambridge, Mass. (USA). Div. of Engineering and Applied Physics). Apr 1974. Contract N00014-67-A-0298-0022. 39p. NTIS $3.25.

The application of superconducting (SOUID) galvanometers as low-noise preamplifiers with considerable bandwidth is explored. The important role of negative feedback in maximizing the bandwidth of these preamplifiers is carefully analyzed. Also discussed is the design and construction of superconducting impedance matching transformers suitable for making the unexcelled noise characteristics of these amplifiers available over a wide range of source impedances. A working preamplifier is described which has exhibited a maximum bandwidth of 10 kHz and noise temperatures in the liquid helium temperature range or below for all source impedances up to a few ohms. The operating characteristics of this preamplifier are compared to the best conventional room temperature amplifiers and are found to be superior for source impedances less than approximately 10 ohms. (auth)

11185 (AD-782719) DIRECT MEASUREMENT OF CURRENT-PHASE RELATIONS IN SUPERCONDUCTING WEAK LINKS. Jackel, L. D.; Buhrman, R. A.; Webb, W. W. (Cornell Univ., Ithaca, N. Y. (USA). Materials Science Center). 15 Jul 1974. Contract N00014-67-A-0077-0016. 17p. (MSC-2260). NTIS $3.00.

A method for the direct measurement of the current-phase I (theta) relations in superconducting weak links is reported. It is shown that by proper choice of experimental parameters, an accurate measurement of I (theta) can be obtained in spite of obscuring effects of thermal fluctuations. This method has been used to obtain the current-phase relation of an oxidized niobium point contact and has shown that it conforms closely to the sinusoidal Josephson relation. (auth)

11186 (AD-783501) WAVE MECHANICAL EFFECTS IN SUPERCONDUCTING MICROCIRCUITS. Final Report. Meservey, R. H.; Lax, B. (Massachusetts Inst. of Tech., Cambridge (USA)). 31 Oct 1974. Contract N00014-67-A-0204-0043. 37p. NTIS $5.00.

The research program was to investigate wave-mechanical effects in superconducting thin-film micro-circuits. Solutions of the Ginzburg–Landau equations for a one dimensional weak link were obtained. Techniques were developed to fabricate weak links in which two dimensions could be controlled in the sub-micron region. A superconducting zero frequency inductance bridge was developed which permits the quantum-phase difference across a superconductor to be measured as a function of the current. This bridge was used to measure the kinetic inductance of superconducting Al thin-film meander lines and can measure an inductance of 10^{-7} H to one part in 1000 to 10,000 with a current of 0.00001 A. With a slight redesign of the input circuit the current quantum-phase relation of superconducting weak links should be measurable with a dc current. (auth)

11187 (AD-784696) CALCULATING SYNCHRONOUS INDUCTIVE REACTANCES OF CONTACTLESS MACHINES WHEN MAGNETIC CIRCUIT IS SATURATED AND OF MACHINES WITH SUPERCONDUCTING EXCITATION WINDINGS. Palastin, L. M. Translated by M. Olaechea from Elektrotekhnika; No. 2, 20-25 (Feb 1973). 25p. (FTD-HT-23-1184-74). NTIS $3.00.

The work studies the effect of magnetic circuit saturation on the synchronous inductive reactance of the armature. A practical method is given for calculating synchronized parameters in saturating synchronized machines with additional clearances and machines with superconducting excitation windings. (GRA)

11188 (COM-74-11374) CHARACTERIZATION OF A SUPERCONDUCTING COIL COMPOSITE. Fowlkes, C. W.; Angerhofer, P. E.; Newton, R. N.; Clark, A. F. (National Bureau of Standards, Boulder, Colo. (USA)). Dec 1973. 52p. (NBSIR-73-349). NTIS $5.75.

The superconducting coil composite material being used by the Annapolis Laboratory of the Naval Ship Research and Development Center is characterized by its mechanical and thermal properties. The Young's moduli, Poisson's ratios, and thermal contractions are measured from room temperature to 4°K and reported. A micro-mechanical analysis based upon volume fractions of constituents is used to predict room-temperature properties, and a comparison is made to the measured values. (GRA)

11189 (CONF-740957-7) SLOW CYCLING FLUX PUMP USING DIGITAL CONTROL. Droege, T. F.; Purcell, J. R.; Wang, S. T. (Fermi National Accelerator Lab., Batavia, Ill. (USA); Argonne National Lab., Ill. (USA)). [nd]. 2p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

A slow cycling flux pump has been constructed where operation is controlled by digital logic driving a high power operational amplifier. Hall sensors allow closed loop control of the secondary currents to enable switching the heater driven power cryotrons at the optimum time. Operating efficiency of 87% has been achieved. (auth)

11190 EXPERIMENTAL PRINCIPLES AND METHODS BELOW 1K. Lounasmaa, O. V. London; Academic Press Inc., Ltd. (1974). 325p. $20.25.

An experimentalist wishing to pursue research at millekelvin (0.001 to 1K) temperatures faces four technical difficulties: how to reach the low temperature, how to measure it, how to reduce the external heat leak so that the low temperature can be maintained for a sufficiently long time, and how to transfer cold from one place to another. Methods which have been developed to provide satisfactory solutions to these problems are described. The three new methods for cooling to 10 mK and below which are now available–^{3}He/^{4}He dilution refrigeration, Pomeranchuk cooling and adiabatic demagnetization of nuclear spins–are discussed, and a section deals with the SQUID (the fundamentally new superconducting quantum interference device), used for measuring magnetic fields with unprecedented sensitivity. The question of temperature measurement is examined, and the choice of thermometers is reviewed. Also, thermal contact, heat transfer, and thermal isolation below 1°K are discussed. Much of the material in this volume is new, and for all with an elementary knowledge of low temperature physics and the properties of matter below 4°K it should prove a valuable, up-to-the-minute work. (auth)

11191 EFFECT OF PHYSICAL AND GEOMETRICAL PARAMETERS ON THE STABILITY OF SUPERCONDUCTING COMPOSITES. Turck, B. (CEN de Saclay, Gif-sur-Yvette, France). Rev. Phys. Appl.; 9: No. 2, 503-514(Mar 1974). (In French).

Engineers designing superconductive devices use several kinds of stabilization. Historically, the cryostatic stabilization principle was used for the earliest magnets built, but our study shows this criterion to be far from obsolete. The influence of different surroundings of the superconductor is analyzed, pointing out the importance of the perturbation initiating the instability in the actual case of the current-voltage curve of the sample. (FR)

11192 SUPERCONDUCTING MAGNET AND ITS APPLICATION. Noguchi, T. (Ulvac Corp., Chigasaki, Japan). Reito; 49: No. 557, 269-277(Mar 1974).

The characteristics of superconducting magnets and their applications are reviewed. The large superconducting magnets which have been made so far are tabulated, and the relations between the magnetic field and inner radius, between magnetic field and current density, and between stored energy and current density are shown. It was found that it is more difficult to make strong fields in a larger space, and current density is smaller in the magnets with larger stored energy. Condition of field stabilization, and the formulas for the central magnetic field, current density, and stored energy of a solenoid are presented. The magnetic field other than the central field can be calculated by the integration of the Biot–Savart law. The electromagnetic force operating on magnet coils is important in case of large magnets. Superconducting magnets for MHD power generation are discussed. The requirements for MHD power generation are satisfied by saddle type coils. The superconducting magnets are also used for nuclear fusion plants. High temperature plasmas should be contained in a vessel by magnetic confinement. At present, large superconducting magnets are practically used in the field of high energy physics. Large bubble chambers require large magnets for which examples are tabulated. (JA)

11193 APPLICATION OF SUPERCONDUCTIVITY TO ELECTRIC EQUIPMENT. I. Generators and Motors. Ogiwara, H. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Japan). Reito; 49: No. 557, 263-269(Mar 1974). (In Japanese).

Superconducting materials can reduce the Joule loss of electric equipment, therefore, superconducting magnets can be operated at high current density, and save the space for generators and motors. Superconducting generators and motors are discussed. Superconducting equipment can save size and weight, and reduce the loss of power. However, they require cryogenic systems and the technique of thermal insulation and cannot be operated by ac power. A generator being developed at present consists of an output coil with ordinary conductor (copper) and a rotating superconducting coil. A cryostat rotates, containing the rotating coil. In 1966, Stekly et. al, published the design of an 8 kW superconducting generator, and in 1970, Thuller et. al, described an 80 kVA synchronous generator. A superconducting motor of 50 horsepower was discussed by Appleton. The development of superconducting apparatus is still in progress. (JA)

11194 MEASUREMENTS OF THE SURFACE RESISTANCE OF A LEAD PLATED, SUPERCONDUCTING, HELICALLY LOADED CAVITY. Judish, J. P. Knoxville, TN; Univ. of Tennessee (1974). 159p. University Microfilms Order No. 74-27,214.

Thesis (Ph. D.).

The surface resistance of superconducting lead was measured at the frequencies 136.7, 233.9, 315.5, 395.9, and 471.6 MHz over a temperature range of 4.2°K to 1.5°K and compared to the calculated predictions of the BCS theory of superconductivity. The surface resistance measurements were made at low field levels up to the onset of the multifactor phenomenon. The variation of the surface resistance with field level was measured at 1.5°K and, at some frequencies, at 4.2°K also. The measurements were made by using an evacuated, lead plated, helically loaded, copper cavity as the frequency controlling element in an oscillating loop. The thickness of the lead plating was estimated to be about 9 μm from an integration of the electroplating current, but about 13 μm to 16 μm from measurements of the room temperature surface resistance of the plated cavity. Measurement of the dc magnetic field along the axis of a second lead plated, helically loaded cavity were also made at room temperature, liquid nitrogen temperature, and 4.2°K to search for the existence of trapped magnetic flux which may be thermoelectrically generated when the cavity is being cooled below the critical temperature of lead. The magnetic field magnitude was found to increase from a few tenths of a milligauss when the cavity was at room temperature or liquid nitrogen temperature, to ten to twenty milligauss after the cavity was cooled to liquid helium temperature. Observations of transient magnetic fields associated with transient thermal phenomena are described. At 4.2°K, even before subtracting a spurious contribution to the measured surface resistance caused by current flow through indium gaskets, the measured values and the theoretical values calculated from the BCS theory agree to within a factor of 1.8 at 136.7 MHz. They agree even more closely at the higher frequencies, the factor being 1.2 at 471.6 MHz. At 1.5°K, well within the residual resistance region, the measured and theoretical values for surface resistance disagree by a factor as high as 120 at 136.7 MHz, down to a factor of 58 at 471.6 MHz. The measured residual resistance was found to increase as the 1.23 power of the frequency over the range of frequencies investigated. At 136.7 MHz and a cavity stored energy of 1×10^{-6} joule, which corresponds to a maximum surface magnetic field of about 2.0 gauss, a residual resistance of 4.6×10^{-9} ohms was observed. This surface resistance corresponds to a cavity Q of 1.77×10^{9}. Possible sources of residual resistance are briefly discussed and compared to measured results. A more detailed comparison is made with results predicted by a theory of Passow concerning a surface resistance component arising from phonon generation. The measured data are consistent with the BCS theory in the weak coupling limit, a residual resistance independent of temperature, and an electron mean free path between about 580 Å and 5800 Å. (Diss. Abstr. Int., B)

11195 METHOD AND APPARATUS FOR CHARGING A SUPERCONDUCTIVE COIL. Ichikawa, H.; Utsunomiya, S. (to The President of the Agency of Industrial Science and Tech.). US Patent 3,848,162. 12 Nov 1974. Priority date 11 Jul 1972, Japan. 8p.

A method for charging a superconductive coil in a flux pump circuit including a power source transformer, a pair of cryotrons, a pair of saturable reactors and the superconductive coil is described. The transformer is saturated to cause a primary voltage to be zero and a secondary current to become constant, a small opposite polarity voltage is applied to a primary winding to cause a short-circuit current to flow, and when the secondary current is reduced to be zero, the cryotron is turned off while the primary voltage continues to be zero during a predetermined time. (Official Gazette)

11196 METHOD FOR SPLICING COMPOUND SUPERCONDUCTORS. Yoo, J. A. (to Varian Associates). US Patent 3,848,075. 12 Nov 1974. Filed date 27 Dec 1971. 6p.

High field compound superconductive members, such as Nb_3Sn, V_3Ga and V_3Si, are spliced by assembling a layer of particulate material containing the constituent elements of a high field compound superconductor between the exposed surfaces of the two members to be spliced. The assembly is heated to reaction temperature in the presence of an inert atmosphere having a trace of carbon vapor to react the constituent particulate matter to form a high field compound superconductive splice between the members being spliced. The carbon vapor can be introduced into the splice by coating or saturating the assembly with a liquid material containing carbon, such as xylene or carbon tetrachloride. As an alternative, an organic liquid material or gaseous material may be introduced into the hot zone of the reaction furnace, as by bubbling the inert gaseous atmosphere of the furnace through an organic liquid or by introducing an organic gas into the inert atmosphere of the furnace. (Official Gazette)

11197 DETACHABLE LEADS FOR A SUPERCONDUCTING MAGNET. Biltcliffe, M. N.; Hanley, P. E.; McKinnon, J. B.; Wheatley, R. W. US Patent 3,839,689. 1 Oct 1974. Priority Date 12 Jan 1972, United Kingdom of Great Britain and Northern Ireland. 4p.

A superconducting magnet coil has current supplied thereto through external connection leads. In the persistent current mode the leads are superfluous since current circulation is maintained by a superconducting link across the coil. Accordingly to prevent heat losses by heat conduction through the leads they have joints so that the leads can be detached from the coil by manipulation from outside the cryostat thus enabling the leads to be completely removed when the magnet is in use. The joints in the leads may comprise screw-threaded male and female members or else plug and socket members. In either case provision is made for reattachment of the leads from outside the cryostat without interruption of the persistent current. (Official Gazette)

11198 JOSEPHSON TUNNELING CIRCUITS WITH SUPERCONDUCTING CONTACTS. Ames, I. (to International Business Machines Corp.). US Patent 3,852,795. 3 Dec 1974. Filed date 3 Jan 1973. 8p.

A Josephson tunnelling circuit is fabricated by forming layers of insulation and superconducting metallization on a substrate. The layers form Josephson tunnelling junctions, superconducting lines, superconducting contacts and other elements which may be needed. Josephson tunnelling junctions are formed by three layers, a thin tunnelling oxide between two superconducting layers. Superconducting contacts are formed between either of the two superconducting layers and an overlying third superconducting layer. The latter layer includes a metal, preferably indium, which has a free energy of oxide formation which is at least as high—or higher—than the alloys forming the first and second layers. (Official Gazette)

Heat Transfer and Fluid Flow

Refer also to abstracts 11096, 13185, and 13186.

11199 (AEC-tr-7600) MEASUREMENTS IN DISPERSED FLOWS. Leonchik, B. I.; Mayakin, V. P. 1971. Translation of Russian Book. 236p. Dep. NTIS $15.00.

The book examines existing methods, devices, and circuits for measurement in dispersed flows, as well as those suggested by the authors. Basic attention is paid to measurements with the goal of controlling and studying technological heat and mass exchange apparatus. The capacities and existing means of measuring the dispersed composition of particles, velocities, concentrations, and temperatures of phases are indicated. Methods of analytically describing the transfer of heat and mass into dispersed flows suggested by the authors are also examined. The specific results of measurements and calculations are cited. The book is intended for engineering-technical workers concerned with problems of controlling and investigating apparatus with dispersed flows, but can also be used by graduate students and students of energetic and chemical-technological specialties in higher educational institutions. (auth)

11200 CALCULATION OF THE HYDRAULIC RESISTANCE COEFFICIENT AND VELOCITY PROFILE FOR TUBES OF REGU-

LAR ROUGHNESS. Ibragimov, M. Kh.; Kozar, L. L. At. Energ. (USSR); 37: No. 4, 297-305(Oct 1974). (In Russian).

Turbulent flow in tubes of regular roughness (consisting of identical protrusions uniformly distributed along the surface of the tube) is considered. The shape of the protrusions is arbitrary. It is assumed that the resistance of a rough tube consists of the resistance of a smooth tube for the given Reynolds number and the sum of the resistances of the roughness elements. To calculate the resistance of a roughness element a method is proposed which takes into account the velocity distribution near the wall of the tube and the mutual effect of protrusions. In considering the mutual effect of protrusions, the authors used an experimental map of the streamlining of roughness elements, on the basis of which the effective values of tube diameter and frontal cross section of protrusions were determined. The velocity profile is uniquely determined by the hydraulic resistance coefficient and Reynolds number. (auth)

11201 FLOW SEPARATION AT CHANNEL DISCONTINUITIES. Markfort, D. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F.R. Germany)). Atomkernenergie; 24: No. 1, 31-35(1974). (In German).

3 figs.; 2 refs.

Flow-separation lengths in the region of channel-discontinuities are of importance when calculating friction losses in this region. Taking advantage of a couple of simplifying assumptions the separation-zones have been defined as functionals of the contraction-coefficient and the aperture ratio, respectively. (auth)

Materials Testing

Refer also to abstracts 11413 and 11462.

11202 (INIS-mf-1553, pp 40) NEUTRON RADIOGRAPHY. Rozental, J. J. (Comissao Nacional de Energia Nuclear de Brazil, Rio de Janeiro). 1973. (In Portuguese).

From 3rd fabrication inspection meeting; Rio de Janeiro (22 Oct 1973).

Because neutron attenuation in materials is different from that of x radiation, neutron radiography has found use in a number of unusual situations. These applications have included the detection of boron diffusion from boron filament in a composite material into an aluminum or nickel matrix as a result of annealing; the location and identification of small explosive charges in metal jacketed assemblies; the radiographic determination of various isotopes such as ^{235}U and ^{238}U; the determination of burnup of ^{113}Cd from neutron irradiated normal cadmium (these determinations are possible because of the higher neutron cross sections of ^{113}Cd and ^{235}U); and the radiographic inspection of heavy metals such as Bi, Pb, and U. Methods of neutron radiography, neutron sources, moderation, and collimation of neutrons were studied. Various systems of neutron radiography are compared. (INIS)

11203 (RDT-F-3-6T(12-74)) NONDESTRUCTIVE EXAMINATION (SUPPLEMENT TO ASME BOILER AND PRESSURE VESSEL CODE, SECTION V). (USAEC Division of Reactor Research and Development, Washington, D. C.). Dec 1974. 13p. RSO.

This standard supplements the requirements of the 1974 edition of the ASME Boiler and Pressure Vessel Code, Section V. When this standard is invoked or referenced, the applicable subsections of Section V of the Code are also invoked or referenced. The user is responsible for obtaining and applying the edition and revisions of this standard that supplement the edition and Addenda of the Code that are in legal effect at the time of use. (TFD)

11204 IMPROVEMENTS TO METALLIC SCREENS USED FOR INDUSTRIAL RADIOGRAPHY. Cheret, J.; Nouvet, A.; Cocoual, N. (to Direction des Constructions et Armes Navales). French Patent 2,176,541. 23 Mar 1972. 4p. (In French).

An improvement to screens and filters used for industrial radiography is described, the improvement aiming at providing a high grade image. The screen and the filter are made from a one-piece metal foil, the overall content of which is at least 99% by weight of elements with an atomic number of from 24 to 30 inclusive and elements with an atomic number of from 74 to 82 inclusive. The metal foil is less than one millimeter thick. (FR)

11205 ACOUSTIC EMISSION: A STETHOSCOPE FOR QUALITY TESTING. Catier, E. Trait. Surface; No. 129, 7-15(Apr 1974). (In French).

The principles of acoustic emission testing are presented. The materials likely to release an emission of acoustic waves when subjected to thermal, mechanical or chemical action are numerous. The occurrences giving rise to an acoustic emission fall into two categories: the weak energy phenomena associated with plastic deformation (twinning, grain boundary slip, etc.); the much more energetic phenomena associated with the fracture mechanisms (initiation and spreading of cracks, inter- and transgranular rupture). A description is then given of the equipment used for analyzing and detecting the acoustic emission. A few examples of applications are: surveillance of the integrity of the structures (pressure vessels, reactor vessels, etc.); and testing of bonded joints and welds. (FR)

11206 NEUTRON RADIOGRAPHY, ITS PRINCIPLES AND APPLICATIONS. van der Kleij, N.; Leeflang, H. P. (Stichting Reactor Centrum Nederland, Petten). Materialpruefung; 16: No. 9, 287-288(Sep 1974).

3 figs. Complete paper, marked MP 531, available from VDI-Verlag Duesseldorf, Postfach 1139.

The principle of neutron radiography is essentially similar to that of X-radiography in that a beam of particles is attenuated on passing through matter, and the attenuated beam forms an image of the object under inspection on some suitable recording material. Neutrons are used in a similar manner as X-rays, although in some circumstances they give a poorer radiograph. Their advantage is that the differences in absorption between portions of a specimen may be much greater for neutrons than for X-rays. (auth)

11207 USE OF POSITRON ANNIHILATION IN MATERIALS TESTING. Balogh, A. (MTA Kristalyfizikai Kutato Csoport, Budapest); Dezsi, I.; Horvath, D.; Kajcsos, Z. Izotoptechnika; 17: No. 9-10, 473-476(1974). (In Hungarian).

The measurement of positron life time, angular correlation of positron-electron pair production, and investigation of vacancies in metals are discussed. (auth)

11208 ACCENTUATION OF CONTRASTS IN ^{60}Co RADIOGRAPHS. Krainer, E.; Nussmueller, E. (Gebrueder Boehler und Co. A.G., Kapfenberg (Austria). Forschungsanstalten). Berg-Huettenmaenn. Monatsh.; 117: No. 7, 268-271(Jul 1972). (In German).

The dependence of wavelength of amplification factors on lead and iron foils is discussed. Measuring of specific contrast according to Dr. Weeber of ^{60}Co radiographs with Pb- and Fe-foils on 40 to 120 mm thick steel specimens and recognition of wire pursuant to DIN 54 109 and comparative radiographs are reported. (auth)

11209 USE OF STEEL FOILS IN γ-RAY RADIOGRAPHY. Becker, E. (Technische Univ., Magdeburg, Ger.); Vorsprach, F.; Bruedigam, G. Isotopenpraxis; 10: No. 9, 342-345(Sep 1974). (In German).

The scattering behavior, amplification factor, and sensitivity of TF 10 and TF 13 films were studied for steel foils 0.3 mm thick using ^{60}Co, ^{137}Cs, and ^{192}Ir radiation sources. The results showed that the steel foils exhibit no amplification factor for the γ radiation of any of the three isotopes. Therefore, steel foils cannot be considered as amplification foils. The image quality with ^{60}Co was increased by factors of 2 to 3, but did not increase with ^{192}Ir. From the measured image quality in the use of ^{60}Co, the previously valid application region of 40 to 120 mm steel could be expanded to both smaller and larger material thicknesses. (JSR)

Nuclear Explosions

Refer also to abstracts 11224, 11254, 11286, 11304, 11584, and 11660.

11210 (AD-782543) SEISMIC WAVES DURING UNDERGROUND NUCLEAR EXPLOSIONS. Kostyuchenko, V. N.; Rodionov, V. N.; Sultanov, D. D. 25 Jul 1974. Translated from pp 3-24 of Seismicheskie Volny pri Podzemnykh Yadernykh Vzryvakh, Moscow, 1971. 27p. NTIS $3.25

11211 (AD-783005) RAYLEIGH WAVE DETECTION AT THREE LP ARRAYS DURING THE ISM. Dean, W. C.; Seggelke, R. M. (Teledyne Geotech, Alexandria, Va. (USA)). 29 Apr 1974. Contract F08606-74-C-0006. 24p. (SDAC-TR-74-8). NTIS $3.00.

Rayleigh waves from each event in the ISM epicenter list were sought at the LASA, ALPA, and NORSAR long period arrays. The method used FKCOMB, a program which computes a three dimensional fourier transform in frequency-wave number space for overlapping four minute windows. The Rayleigh wave detection rates, missed signal rates, and false alarm rates measured at these three long period arrays during the international seismic month are discussed. (auth)

11212 (AD-783299) EXTENDED ARRAY EVALUATION PROGRAM. Special Report No. 7. Continued Evaluation of the Nor-

wegian Long-Period Array. Laun, P. R.; Shen, W. W.; Swindell, W. H. (Texas Instruments, Inc., Dallas (USA)). 2 Nov 1973. 144p. NTIS $4.75.

The results of the continued evaluation of the Norwegian long-period seismic array (NORSAR) by Texas Instruments, Incorporated at the Seismic Data Analysis Center during the period 1 April 1972 to 31 Mar 1973 are described. The NORSAR evaluation was concerned with five major areas of study: noise analysis, array processing performance; effectiveness of matched filters; surface wave detection capability; and performance of standard surface wave discriminants. The evaluation used 324 Eurasian events and 32 noise samples during the period of 1 Jan 1972 to 26 Dec 1972. (auth)

11213 (AD-783329) RESEARCH IN SEISMOLOGY. Annual Report, 1 April 1973–31 March 1974. Press, F.; Toksoz, M. N.; Aki, K.; Solomon, S. C. (Massachusetts Inst. of Tech., Cambridge (USA)). 1974. Contract F44620-71-C-0049. 190p. (AFOSR-TR-74-1254). NTIS $5.50.

Work within four broad areas is described: (1) theoretical and observational studies of source mechanisms of earthquakes and underground nuclear explosions; (2) wave propagation in heterogeneous and anisotropic media; (3) regionalization of earth structure; and (4) array and data processing techniques for event detection and location. All publications and theses completed during the contract year are listed. (auth)

11214 (AD-783607) EXTENDED ARRAY EVALUATION PROGRAM. Special Report No. 15. Evaluation of an Adaptive Three-Component Filter. Lane, S. S. (Texas Instruments, Inc., Dallas (USA); Air Force Technical Applications Center, Alexandria, Va. (USA). Vela Seismological Center). 30 Nov 1973. 36p. NTIS $3.25.

The three-component adaptive filter takes advantage of the phase relations between radial, vertical, and tangential seismometer traces which hold when Rayleigh and Love waves are present. This study finds that adaptively processed data has up to 6 db greater signal-to-noise ratio than simple bandpassed data. The detection threshold for single site data is lowered by an amount consistent with this gain, but the detection threshold for beam data is unchanged. An explanation for this difference, based on the character of single site and beam noise fields, is presented. Azimuthal discrimination and response of the filter to random noise are investigated. (auth)

11215 (AD-783608) EXTENDED ARRAY EVALUATION PROGRAM. Special Report No. 16. Preliminary Comparison of Automatic Fisher and Conventional Power Detection Algorithms. Lane, S. S. (Texas Instruments, Inc., Dallas (USA); Air Force Technical Applications Center, Alexandria, Va. (USA). Vela Seismological Center). 30 Nov 1973. 40p. NTIS $3.25.

The performance of two seismic event detectors, the Fisher detector and the conventional power detector, was compared. Long-period records with low signal-to-noise ratios, recorded at the Alaskan long period array, were used to establish performance characteristics, sensitivities, response to off-azimuth events, and response to signal distortion. Results confirmed the theoretical prediction that there is no important distinction between the detectors. (auth)

11216 (AD-784348) DETERMINATION OF PP AND SP DELAYS FROM SEISMIC CODAS. Final Report. Page, E. A. (Air Force Technical Applications Center, Alexandria, Va. (USA); Advanced Research Projects Agency, Washington, D. C. (USA)). 31 Mar 1974. Contract F08606-74-C-0020. 57p. NTIS $3.75.

Work performed to determine the feasibility of making significant improvements in seismic depth phase detection using statistical signal processing is described. The feasibility was demonstrated for a single event analyzed by six stations. (auth)

11217 (CEA-R-4578) TWO-DIMENSIONAL ELASTO-PLASTIC PROGRAM: ORION CODE SPECIFICATIONS. Chabaud, M.; Dupia, M. F.; Pornet, J.; Sainte-Marie, J. P.; Terrier, M. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Nov 1974. 63p. (In French). Dep. NTIS (US Sales Only) $6.25.

ORION code is a two-dimensional computer program written in Lagrangian coordinates from which dynamic phenomena resulting from an explosion (whether it be nuclear or not) taking place in hydrodynamic or elastic media can be computed. Differential equations governing the phenomena under study are discretized according to a finite-difference scheme given by M. Wilkins, the zone under study being divided into different meshes. The Lagrangian formulation assigns for each mesh the conservation of its initial mass during its evolution in space and time with possibilities of alterations in shape. The latter aspect will require to have at one's disposal different kinds of meshes to make the choice best suited to the problem and to avoid the premature stopping of computation due to mesh crossing. ORION code has been written in an axisymmetric geometry, the symmetrical parts being torus with quadrilateral sections. (auth)

11218 (COM-74-11472) ALEUTIAN STRAIN MEASUREMENTS. Final Technical Report, 1 July 1969–30 June 1973. Major, M. W. (Colorado School of Mines, Golden (USA)). Jun 1974. 19p. (NOAA-04-3-022-1; NOAA-74080608). NTIS $3.00.

A continuous study of earth deformation in the central Aleutians was conducted by the Colorado School of Mines and the Earthquake Mechanism Laboratory of the U. S. Department of Commerce during the four years between 1 July 1969 and 30 June 1973. The objectives of the study were to: (1) determine the size of both the residual and quasi-static deformations associated with certain underground nuclear explosions; (2) determine the rate of tectonic deformation of the area during the interval of time between two such explosions; (3) monitor deformation for some time after the last explosion; and (4) conduct such other studies related to seismology and earthquake prediction as might be appropriate without handicap to the execution of the first objectives. Results cited in other publications are presented in abstract form. (GRA)

11219 (FOA-C-20018-T1) SEISMIC EVENTS IN THE USSR IN 1972. Austegard, A. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Nov 1974. 37p. Dep. NTIS (US Sales Only) $5.00.

A list of seismic events during 1972 in mainland USSR has been compiled from bulletin data, given by the National Oceanic and Atmospheric Administration US (NOAA), the Institute of Physics of the Earth, Moscow (MOS) and the Hagfors Observatory (HFS) in Sweden. In addition data from the large aperture arrays NORSAR in Norway and LASA in the US has been utilized. Regional seismicity, focal depths, magnitudes and discrimination between explosions and earthquakes have been studied. Some of the results are in substantial agreement with the ones from a similar study on USSR events during 1971, even if some differences are observed. Data from LASA and NORSAR, which was not used for the study on 1971 events, was found to contribute about 10% of the events of the 1972 list. A significant number of events reported by only LASA or NORSAR could not be confirmed by other stations in Northern Europe and North America and these events are not included in the 1972 list. MOS and NOAA were found to give concordant depth estimates which for most of the events agreed within 30 km. In some cases SS phases recorded at HFS provided valuable information on the focal depth. Earthquakes recurrence relations for the body wave magnitude were studied and minor regional variations were observed. The discrimination procedure, which was developed for the 1971 data, was applied to the 1972 data and gave satisfactory results. (auth)

11220 (JPRS-62595) EFFECT OF UNDERGROUND EXPLOSIONS AND CHANGES IN PROPERTIES OF A MEDIUM IN A SEISMICALLY ACTIVE REGION. Sadovskii, M. A.; Kostyuchenko, V. N.; Sobolev, G. A.; Slavina, L. B. Translated from Dokl. Akad. Nauk SSSR; 215: No. 5, 1097-1104(1974). 17p. NTIS $3.00.

Seismic action of underground explosions and rapid changes of electrical and seismic properties of a medium in a seismically active region are discussed. (GRA)

11221 (SLA-73-0918(Vol. 1)) RESULTS OF GROUND MOTION AND AIRBLAST MEASUREMENTS, PROJECT ESSEX I, PHASE 1. Volume I of 2. Vortman, L. J.; Beyeler, J. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 236p. Dep. NTIS $14.75.

Four high-explosive charges were detonated in saturated soil to simulate employment of atomic demolition munitions. Two 10-ton charges were buried 12 meters deep, one stemmed and one with a small open hole; one 10-ton stemmed charge and one 8.5-ton unstemmed charge were at 6 meters. On each shot instruments measured shock propagation above the charge, shock stress and ground acceleration at one position at half-shot depth and at three shot-depth positions, ground-surface acceleration at four to five positions, shock pressure in the open holes of the unstemmed shots, and above-ground airblast at several distances. Ground-surface displacement was measured with high-speed photography. Peak stresses ranged from 0.05 to 3 kilobars. These measurements were made to provide information on effects of charge burial depth and stemming, as well as physical data that could be used to verify the hydrodynamic codes being used for numerical simulation of ADM explosions. An internally consistent set of measurements of all parameters was obtained on each shot. The measurements were especially well suited to the objectives but heterogeneity of the soil obscured subtle effects of stemming differences and detracted from the precision with which codes can be verified from the measured data. Suppression of airblast was found to be a reasonable

analogue of nuclear radioactivity suppression and a promising alternative to the use of a radioactivity simulant for that purpose. Airblast measurements on five 1,000-lb surface and near-surface detonations showed that differences in meteorology on the different days the shots were fired obscured the subtle differences that could be attributed to charge position. (auth)

11222 (SLA-73-0918(Vol. 2)) RESULTS OF GROUND MOTION AND AIRBLAST MEASUREMENTS, PROJECT ESSEX I, PHASE 1. Volume II of 2. Vortman, L. J.; Beyeler, J. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 580p. Dep. NTIS $32.00.

Recorded data on ground motion and airblast in support of the text in Vol. 1 of this report are presented. (TFD)

11223 (UCID-16596) STRAIN SEISMOMETER DATA FROM THE CATHAY EVENT. Olsen, C. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

The CATHAY nuclear event was conducted at the USAEC's Nevada Test Site on Oct. 8, 1971. Surface-ground-zero for CATHAY was 1699 m from the tie-point of the three component strain-seismometer stations on an azimuth of S1.9°E. BRK and ERL both reported a body-wave magnitude of 4.7 for CATHAY. Surface collapse occurred about 63.8 minutes after detonation. Dynamic strain data from the three components are given in graphic form. (TFD)

Protective Structures and Equipment

11224 (AD-783008) DAMAGE ASSESSMENT MODEL FOR TEST AND EVALUATION OF LOCAL CIVIL DEFENSE EMERGENCY OPERATING SYSTEMS. Final Report. Kiernan, J. D.; Severo, J. P. (Institute for Defense Analyses, Arlington, Va. (USA)). Dec 1973. Contract DAHC20-70-C-0278. 126p. NTIS $4.75.

A revision and extension of one component of a large computer-based local civil defense operations model are described. The model was developed as three discrete but interrelated submodels. The paper is concerned only with the first submodel—a computerized local damage assessment model (IDAM)—and provides documentation of the revision of the model to make it operable. (auth)

11225 (CONF-741132-1) INSPECTION FREQUENCY OF RESPIRATORS STORED FOR NON-ROUTINE USE. Bolton, N. E.; Whitaker, G. R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 12p. Dep. NTIS $4.00.

From 2nd respirator symposium for AEC contractor and licensee health and safety personnel; Livermore, California, USA (13 Nov 1974).

A study undertaken to determine the minimum inspection frequency necessary to insure the adequacy of respirators stored for non-routine use is described. (auth)

11226 DOUBLE WALL GLOVEBOX (4 JAN 1971)(ENGINEERING MATERIALS). (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). (CAPE-2398). 7 drawings.

ENVIRONMENTAL AND EARTH SCIENCES

Minerals and Ores

Refer also to abstracts 10524, 11265, 11275, and 11414.

11227 (GJO-103(74)) URANIUM EXPLORATION EXPENDITURES IN 1973 AND PLANS FOR 1974-75. (USAEC Grand Junction Office, Colo.). Apr 1974. 12p. Dep. NTIS $4.00.

A survey of uranium exploration expenditures for the calendar year 1973 was made by the Grand Junction Office of the U. S. Atomic Energy Commission during February and March, 1974. A total of 89 companies returned questionnaires. The work was done as part of the AEC's overall program of evaluating exploration activities for nuclear fuel supplies. A compilation is presented of data from the replies of the 84 active companies that reported cumulative uranium exploration expenditures of $49.5 million in 1973. Table I is a general summary of 1973 results, compared with figures for the previous seven years. (auth)

11228 COMPOSITION OF URANINITE FROM PEGMATITE AND URANIUM-MOLYBDENUM TYPE DEPOSITS. Strel'tsov, V. A.; Boronikhin, V. A.; Tishkin, A. I. At. Energ. (USSR); 37: No. 4, 306-315(Oct 1974). (In Russian).

The composition of uraninite from pegmatite and uranium-molybdenum type deposits was investigated on Kameka electron microanalyzer MS-46. It was found that calcium and iron are uniformly distributed throughout the mineral. These elements should be considered isomorphic with uranium. Uniformly distributed zirconium was not observed. Its local concentration is due to the micro-dissemination of zirconium. Only a small portion of the total content of lead is associated with disseminated galenite. The difference in compositions is due to the absence in uraninite from a uranium-molybdenum type deposit of thorium and rare earths, as well as less lead content and greater calcium content. (auth)

11229 GEOCHEMICAL AND RADIOMETRIC BEHAVIOR OF URANIUM AND OTHER RADIOACTIVE ELEMENTS IN RELATION TO EXPLORATION FOR SECONDARY URANIUM. Davy, R. AMDEL (Aust. Miner. Develop. Lab.). Bull.; No. 17, 17-32(Apr 1974).

Aspects of the behavior of radioactive elements occurring in the natural environment and the way that these elements can be used in the search for uranium ore bodies are reviewed. (auth)

11230 HARD ROCK MINING IN AUSTRALIA: 1973-1974. Aust. Mining; 66: No. 9, 18-28(Sep 1974).

A survey is presented of hard rock mines (including uranium), which gives names and locations of operating mines and economic mineral prospects likely to come into production. (AT)

11231 METHODS OF STUDYING THE MIGRATION PARAMETERS OF LEAD IN URANIUM MINERALS. Ershov, V. M. (Inst. of Geophysics, Sverdlovsk, USSR). Geokhimiya; No. 10, 1565-1568(Oct 1974). (In Russian).

The validity of the sublimation method for the determination of the migration parameters of Pb in U minerals was evaluated. Measurements on pitchblende samples confirmed the calculations that the fraction of Pb in the "non-stable" zone does not depend on its absolute age which varies within wide limits and exceeds the calculated values. During calculation of the migration coefficient using the Fourier criterion the crystallite dimensions and not the grain dimensions must be used. (JSR)

11232 ORIGIN OF SANDSTONE TYPE URANIUM DEPOSITS IN WYOMING. De Nault, K. J. Stanford, CA; Stanford Univ. (1974). 373p. University Microfilms Order No. 74-27,007. Thesis (Ph. D.).

An examination of a uranium roll in the Red Desert, Wyoming, has shown the following outstanding mineralogic differences between fresh and altered ground: hornblende, pyrite, and zircon are removed from altered ground. Hornblende crystals in fresh ground show pronounced solution features and they are uraniferous. Pyrite is found in three morphologic varieties in fresh ground, octahedra, framboids, and small massive grains, all of which are uraniferous. In mineralized ground, framboidal pyrite has grown and is the dominant form. Framboids in both fresh and mineralized ground are composed of small discrete tetrahedra. Anatase replaces ilmenite in mineralized and altered ground. In Wyoming, most commercial concentrations of uranium are found in coarse grained sands of early Eocene age. Host sands were covered by a thick sequence of sediments composed predominantly of volcanic ash which contain anomalous concentrations of uranium. These ash-rich sediments are the most likely source for uranium in underlying coarse grained sands. One of the oldest of these ash-rich units, the White River Formation of Oligocene age, is generally impermeable and effectively blocked downward migration of uraniferous oxygenated groundwaters. A lack of an influx of oxygenated ground waters coupled with an abundance of organic debris produced a strongly reducing moderately basic environment in host sands. Pyrite and calcite precipitated. Normal faulting occurred in late Pliocene time, providing channelways for an influx of uraniferous groundwaters which were low enough in pH to dissolve calcite, oxidizing enough to transport selenium, change pyrite to goethite, ilmenite to anatase, and sufficiently rich in bicarbonate to transport uranium and dissolve zircon. As oxygenated groundwater continued to influx, selenium, uraninite, pyrite and calcite dissolved on the altered side and precipitated on the reduced side of a roll. (Diss. Abstr. Int., B)

11233 URANIUM IN ULTRABASIC XENOLITHS FROM BASALTS. Komarov, A. M.; Zitkov, A. S. Izv. Akad. Nauk SSSR, Ser. Geol.; No. 10, 79-85(Oct 1973). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Geol. Ser.

The concentration and distribution of U was studied by the method of fission-track radiograms. Xenoliths principally from continental basalt lavas of different parts of the world were studied. The total content of U in the majority of samples was about 10^{-6} g/g. Rock-forming minerals of xenoliths, such as rhombic, the majority of the monoclinic pyroxenes, and spinel, contain U of the order of 10^{-9} g/g, but in olivine it is 10^{-10} g/g. However in some xenoliths the U concentration in monoclinic pyroxenes is significantly higher and reaches 10^{-6} g/g. The U in accessories in xenoliths is almost completely absent. A large part of the U in xenoliths is confined to intergranular fragments, joints, and alteration zones. The U in rock-forming minerals is primary, but in interstices it can be introduced from basalt. If primary U is present in the intergranular form, then its quantitative ratio with the introduced U is unclear. (tr-auth)

11234 SOME PECULIARITIES OF TRACE URANIUM IN THE UPPER PERMIAN SANDSTONES OF NORTH-WEST DONBASS. Lepkij, S. D. (AN Ukrainskoj SSR, Kiev. Inst. Geokhimii i Fiziki Mineralov). Geol. Zh. (Russ. Ed.); 33: No. 6, 113-115(Jun 1974). (In Russian).

Uranium in sand may enter into the lattice of the minerals—zircon, monazite, xenotime, apatite—or it may be combined with titanium minerals—ilmenite, rutile, sphene, anatase. The uranium may also be adsorbed on iron oxides or hydroxides and clay minerals. Samples weighing 50 kg from the upper Permian sands were studied after separation into slimes, light fractions ($d < 2.61$), and heavy fractions ($d > 2.61$). The uranium content of the quartzes and feldspars was low ($0.2-5 \times 10^{-4}$), while the metal and aluminosilicate contents were of the order of tenths of a percent. Real uranium minerals and unchanged rocks were absent. The largest amount of uranium was with the clay particles (about 60%), and the heavy and light fractions (about 40%). In the heavy fraction the uranium was found with iron sulfides, pyrites, and marcasites. Radioactivity in the light fraction was due chiefly to uranium sorbed on iron hydroxides. Mineral carriers of natural pyrite-marcasite fraction. Less than 1% of the metal is in this fraction. (tr-INIS)

11235 A CONTRIBUTION TO USING THE FISSION TRACK METHOD IN INVESTIGATION OF CRYSTALLINE ROCKS. Kirichenko, N. M.; Goncharov, V. P. Geol. Zh. (Russ. Ed.); 33: No. 6, 103-108(Jun 1974). (In Russian).

Results of tests on the use of the fission track method for studying crystalline rocks and minerals of the Ukrainian shield-granites, pegmatites, gniesses, and biotite-amphibole and amphibole-plagioclase rocks and various types of micas-are reported. The high sensitivity of the fission track method and especially its high visualization of the actual distribution of U in different rocks make it useful in many geochemical studies, particularly the concentration and migration direction of U in minerals and the nature of its distribution in rocks. It was established that the introduction of U in mica minerals is explained by the very low clarke of U in micas. The U content in mica samples varied from 0.42 to 1.83×10^{-6}%. The temperature regime of the U distribution can be evaluated from the nature of the distribution of U segregation in mica crystals. (tr-INIS)

11236 ON THE STRUCTURAL CONTROL OF THE URANIUM DEPOSITS IN STRATUM OXIDATION ZONES. Shchetochkin,

V. M.; Shmarnovich, E. M.; Levdonskij, V. A. Geol. Rud. Mestorozhd.; 16: No. 1, 104-109(Jan 1974). (In Russian).

Uranium deposits in sandy and sandy-clayey non-metamorphosed precipitated covering layers were examined. The mineralization is combined with regions of intensive development of reductive changes and with regions of reductive and infiltrative oxidation processes. In the cores are rocks in a low structural stage. At the limits of these zones are deposits of two or three differently oriented systems of coarse cuts, with location of deposits inside these nodes due to regions of interaction of small disjoined structures having periclinal or lateral sloping anticlinal secondary series with zones of flexure bends in the strata and regions of damping out or linked zones. New formations of reduced epigenesis are controlled directly by fine elements, usually in the form of systems of cracks that are longitudinal, diagonal or perpendicular to the basic cut lines. In some cases these may be considered as ore feeder channels and fracture zones. Favorable collections of elements are due to the significant penetrability of the regions. (tr-INIS)

11237 URANIUM CONTENT IN OCEANIC PHOSPHORITES. Baturin, G. N.; Kochenov, A. V. (AN SSSR, Moscow. Inst. Okeanologii). Litol. Polez. Iskop.; No. 1, 124-129(Jan 1974). (In Russian).

For English translation see the journal Lithol. Meniral. Resour.

Results are presented on the determination of uranium content and P_2O_5 in 65 phosphorite samples collected by Soviet expeditions in various regions of the ocean and taken from the corresponding data of foreign scientists. For comparison the uranium content was also determined in 6 samples of phosphorites and phosphate minerals of the Russian Platform. The age of the ocean phosphorites was Eocene and Early Pleistocene. The content of P_2O_5 in the material under study depending on the amount of nonphosphate impurities was 4.56 to 32.77%, while the uranium content was 3 to 166×10^{-4}%. In contemporary phosphoritic concretions (West African shelves) the uranium content is 3 to 166×10^{-4}%. In littoral phosphoritic concretions the uranium content was $52 \pm 25 \times 10^{-4}$%, and the U/P_2O_5 coefficients were $2.3 \pm 0.8 \times 10^{-4}$%. The close values in uranium content (on the average 38×10^{-4}%) and U/P_2O_5 ratio (on the average 32×10^{-4}%) are also noted in samples of phosphorites and phosphate minerals of the Russian Platform. In biogenic phosphates (scales, fish bones, and mammal bones) the process of uranium accumulation takes place more actively. This behavior is connected with the porous structure of bone tissue, the low degree of bone phosphate crystallization, and the high content of organic matter in bone phosphate. (tr-INIS)

11238 EFFECT OF EMANATION ON THE RESULTS OF THE γ SPECTRAL DETERMINATION OF THE RADIUM CONCENTRATION IN STEPPE SOIL. Novikov, G. F.; Makarov, M. S.; Glatoleva, A. G. (Leningrad State Univ.). Izv. Vyssh. Ucheb. Zaved., Geol. Razved.; No. 8, 132-137(1974). (In Russian).

The character of the distortion of the results of γ spectral mapping on the total background of the change of the emanating properties of the soil of the region was studied and the relation of size of the error in the γ spectral method to the value of the coefficient of emanation were experimentally determined for the steppe soil from Volgograd Povolzh. The evaluation shows that the atmospheric Rn released from the soil distorts the results of the γ spectral mapping in the steppe zone much less than theoretical calculations indicate. (JSR)

11239 URANIUM AND THORIUM IN EVOLUTION PROCESSES OF GEOSYNCLINE DEPOSITS OF THE GORNYI ALTAI AND THE WEST SAYAN. Mitropol'skii, A. S.; Mel'gunov, S. V. (Inst. of Geology and Geophysics, Novosibirsk, USSR). Dokl. Akad. Nauk SSSR; 216: No. 5, 1150-1153(11 Jun 1974). (In Russian).

Results of the study of the reef and Paleozoic stratified deposits of Gornyi Altai and West Sayan were discussed. The radiogeochemical characteristics of the deposits were based on the analysis of representative samples taken from the most important varieties of rocks. The samples were analyzed for U by the luminescent method and for Th by the photocolorimetric method. The distribution of the average contents of U and Th was determined. The greatest contrast in the individual properties of the deposits was in the variation of the content and distribution character of Th. (JSR)

Radioactive Effluents

Refer also to abstracts 11248, 11292, 11694, and 13319.

11240 (BNWL-SA-5024) RADIOISOTOPE RATIOS IN CHARACTERIZING THE MOVEMENT OF DIFFERENT PHYSICAL AND CHEMICAL SPECIES THROUGH NATURAL SOILS. Robertson, D. D.; Perkins, R. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 2 Oct 1974. Contract AT(45-1)-1830. 21p. (CONF-741120-6). Dep. NTIS $4.25.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

Physicochemical characterization studies of reactor effluent water radionuclides at the Hanford N-Reactor provided important information describing the mobility of radionuclides in freshwater environments. At N-Reactor, cooling water containing a wide spectrum of radionuclides in various physicochemical forms is discharged to a seepage trench located near the reactor. The effluent water migrates through a soil bank between the trench and the Columbia River, and a portion of the water emerges as seepage springs along the bank of the Columbia River near the reactor. The mobility of effluent water radionuclides during transport through the soil is greatly dependent upon the physicochemical forms of the radionuclides. Radionuclides in particulate and cationic forms are nearly quantitatively retained in the soil bank by sorption onto mineral phases, whereas radionuclides in anionic and soluble nonionic forms are relatively mobile and are retained by the soil to a much lesser degree. Several radionuclides such as ^{58}Co, ^{60}Co, $^{103-106}Ru$, and $^{122-124-125}Sb$, ^{131}I, and ^{133}I are present in reactor effluent water partitioned among particulate, cationic, anionic and nonionic species. However, as these radionuclides migrate through the soil bank their particulate and cationic forms are retained, and predominantly anionic and nonionic forms emerge in the seepage springs. Studies of the behavior of these radionuclides provide data for assessing present rad-waste treatment processes and in improving future processes for reducing environmental releases of radionuclides from nuclear installations. (auth)

11241 (BNWL-SA-5184) NUCLEAR POWER AND POLLUTION. Foster, R. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 19p. (CONF-741129-2). Dep. NTIS $4.00.

From annual meeting of the Pacific Northwest Pollution Control Association; Richland, Washington, USA (6 Nov 1974).

The following classes of waste from nuclear power plants are discussed: heat removed from the steam condenser; chemicals used to prevent fouling or corrosion of the condenser; and radioactive materials associated with the reactor core. Various steps in the fuel cycle are described and the following types of pollution are discussed: dust and radioactive radon gas in atmosphere of uranium mines; water evaporating from tailings ponds of mills; air-borne fluorides from UF_6 plants; effluents from coal-fired power plants supplying electric power for enrichment plants; fluorides in aqueous effluents and stack gases from fuel fabrication plants; contamination of fish and shell fish pumped through condensers with cooling water of nuclear power plants; ^{85}Kr and tritium released to the atmosphere from fuel reprocessing plants; pollution of land used for waste storage facilities. (HLW)

11242 (BNWL-SA-5189) TRANSURANIUM ELEMENTS IN THE ATMOSPHERE. Thomas, C. W.; Perkins, R. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 20p. (CONF-741086-7). Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

Releases of transuranium elements into the atmosphere from nuclear weapons testing, reactor operation, nuclear plant accidents, and the transport of nuclear weapons are reviewed. The abundance of ^{241}Am, ^{240}Pu, and ^{241}Pu resulting from nuclear explosions is discussed. It is pointed out that substantial amounts of Am and Cm isotopes are formed from the burning of ^{235}U and ^{239}Pu during the operation of reactors. The abundance of ^{241}Am, ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{137}Cs, ^{237}U, and ^{239}Np in fallout is discussed. Nuclear debris from Chinese weapons tests was examined to estimate the radiation exposure resulting from individual short-lived radioisotopes and results are tabulated. (HLW)

11243 (INIS-mf-1339) ENVIRONMENTAL CONSEQUENCES OF NUCLEAR AND CONVENTIONAL EXTENSION OF POWER PLANTS. A Statement Submitted to the Ministry of Commerce, Shipping, and Industry by the Energy Committee of the Power Plants. (Handelsministeriet, Copenhagen (Denmark)). Mar 1974. 18p. (In Danish). INIS.

The environmental aspects are treated as seen from the year 1990 and include air pollution, thermal release, water pollution, safety, waste, transport and noise. The man power needed for construction and running of plants is calculated, the size of the area required and the aesthetics are touched upon, and finally de-commissioning is treated. (INIS)

11244 MARINE POLLUTION: A FRAMEWORK FOR INTERNATIONAL CONTROL. Danzig, A. L. Ocean Manage.; 1: No. 4, 347-379(Dec 1973).

It is suggested that nothing short of international measures are required to avert the grave dangers threatening the marine environment. These threats come by land, sea, and air in the form of effluents from our rivers, air-borne contaminants such as DDT coming from our activities on land, and irresponsible discharges, such as the dumping of radioactive wastes. It is the author's view that unless these measures are backed by strong enforcement regulations they will be ineffective and he suggests a form of treaty that would embody such objectives. (NL)

11245 INTERNATIONAL INSTITUTIONS FOR RATIONAL MANAGEMENT OF OCEAN SPACE. Wenk, E. Jr. (Washington Univ., Seattle). Ocean Manage.; 1: No. 2, 171-200(Jul 1973).

During the last six years, the community of nations has come to realize that most of our world is ocean, and has taken unprecedented steps to relate its resources and its amenities to the affairs of man. Formal resolutions have been adopted by the U.N. General Assembly on the role of the oceans in extending world order, in meeting protein malnutrition, in providing energy and minerals, and in fostering economic health of developing nations. Corresponding attention has been focused on measures to protect the health of the marine environment against unwitting waste disposal. To extract these benefits, a wide range of recommendations have been introduced for necessary legal arrangements, to be considered at the forthcoming Law of the Sea Conference. Proposals are advanced for rational management of ocean space to identify collective goals, develop priorities to harmonize programs of specialized agencies, to collect, analyze and disseminate necessary data, engage in future planning and to identify needs for further international cooperation. Necessary planning and coordination would be undertaken through a set of five complementary committees which already exist in specialized agencies, ECOSOC, and the U.N. Secretariat. By using existing structures and strengths, only modest additions to staff would be necessary to gain immediate and substantial improvements in international cooperation, including collaboration with new activities associated with the global environment. IAEA, FAO, and WHO are named among the participating organizations. (NL)

11246 POLLUTION OF THE OCEANS: AN INTERNATIONAL PROBLEM. Matthews, G. (United Nations, New York). Ocean Manage.; 1: No. 2, 161-170(Jul 1973).

In order to assess the degree of seriousness of pollution of the marine environment, much research still needs to be done about the sources, the routes to the sea, and the fate and effects of pollutants in the oceans. However, it is already clear that at least on a local scale marine pollution can cause considerable harm. Because the capacity of the ocean to assimilate and render harmless the waste matter poured into it has rightly been questioned, because these pollutants do not respect political boundaries, and because the major part of the marine environment lies outside national jurisdiction, marine pollution is fundamentally an international problem, calling for international action. Because national action will come first, it is essential to coordinate this work at an international level. It should be ensured that the same standards are used everywhere, and that the information which is gathered in this way will be made available internationally. Finally, it will be necessary to develop appropriate international laws, establishing the responsibility of individual states for the preservation of the marine environment. (NL)

Radioactivity Monitoring and Transport

Refer also to abstracts 10698, 11241, 11243, 11584, and 11659.

11247 (Cmnd-5703) REPORT BY THE CHIEF INSPECTOR OF NUCLEAR INSTALLATIONS ON THE INCIDENT IN BUILDING B204 AT THE WINDSCALE WORKS OF BRITISH NUCLEAR FUELS LIMITED ON 26 SEPTEMBER 1973. (Department of Energy, London (UK). Nuclear Installations Inspectorate). Jul 1974. 25p. Dep. NTIS (US Sales Only) $4.50.

A release of airborne radioactivity occurred in the Head End fuel reprocessing plant. Thirty five people who were in the building at the time were found to have external contamination and contamination of the lungs, mainly from ruthenium-106. A description of the incident and its consequences are given. The plant and chemical process are discussed, with flowsheet chart, diagrams, and photograph. Investigations into the nature of the incident are described. The radiation protection system is also described. Details are given of the exposure of personnel. The report concludes with the recommendations for improving the protection of operators. (UK)

11248 (NP-20256) NUCLEAR POWER PLANT BY THE OSLOFJORD. Introductory Radioecological Studies. (Norges Vassdrags- og Elektrisitetsvesen, Oslo. Direktoratet for Statskraftverkene). Jan 1974. 188p. (In Norwegian). Dep. NTIS (US Sales Only) $12.50.

Calculated radiation doses are presented for individuals in nominal critical groups, resulting from releases of radioactive materials to the atmosphere and to the cooling water recipient from a nuclear power plant. The calculations include internal doses from food contaminated by atmospheric releases and by cooling water together with external doses from releases to the cooling water recipient. The nominal collective doses to the thyroids of children from radioactive iodine in milk has also been calculated. An evaluation has also been made of the extent of contamination following a reactor accident. It is pointed out that in interpreting the calculated results it should be borne in mind that the data used is partly incomplete, especially regarding the amount and composition of the releases and the population's use of the food resources. Direct radiation from the release of inert gases to the atmosphere and radiation doses from the inhalation of radioactive materials is not considered in this report. (NORW)

11249 (ORNL-tr-2876) DEVELOPMENT OF A TECHNIQUE FOR STUDYING MUD TRANSFER IN AN ESTUARY. Gouriez, P.; Sauzay, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 24 Jan 1974. Translation by Martha Gerrard of DCh/ARS-74-02. 12p. Dep. NTIS $4.00.

Tracer experiments using ^{46}Sc to study the transport of sediments in the Gironde Estuary near Bordeaux, France are described. (LCL)

11250 (RISO-307) ENVIRONMENTAL RADIOACTIVITY IN GREENLAND IN 1973. Aarkrog, A.; Lippert, J. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jul 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

Measurements of fallout radioactivity in Greenland in 1973 are reported. Strontium-90 (and ^{137}Cs) in most instances) was determined in samples of precipitation, sea water, vegetation, animals, and drinking water. Estimates of the mean contents of ^{90}Sr and ^{137}Cs in the human diet in Greenland in 1973 are given. (DE)

11251 (TID-26688) ENVIRONMENTAL REPORT FOR CALENDAR YEAR 1973 ON RADIOLOGICAL AND NONRADIOLOGICAL PARAMETERS. (Battelle Columbus Labs., Ohio (USA)). 18 Apr 1974. Contract W-7405-eng-92. 22p. Dep. NTIS $4.25.

Based upon the environmental sampling data presented in this report, Battelle-Columbus contract nuclear activities have not released any significant amount of radioactive or non-radioactive contaminants to the environment during calendar year 1973. The annual average concentrations of radioactivity in the liquid and airborne effluents were within the appropriate concentration guide limits according to AEC Manual Chapter 0524. The non-radioactive water sampling data comply with the Water Quality Standards of the State of Ohio as adopted by the Ohio Environmental Protection Agency. (auth)

Atmosphere

Refer also to abstracts 10573, 11238, 11240, and 11280.

11252 (BNWL-1836) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1974. Contract AT(45-1)-1830. 25p. Dep. NTIS $4.00.

Research progress in various programs devoted to waste disposal, as well as routine measurements and maintenance of facilities, are reported. Surficial contamination and airborne release studies are underway. The results of Cs-137 measurements in experiments generated to determine fractional airborne release of radionuclides during the heating of contaminated surface materials are given. Studies on the mass and distribution of soil particles, carried through a wind tunnel, support earlier findings that radioactive constituents are associated largely with the fine fraction of the soil. Environmental evaluations of the radioactivity in the Columbia River and soils and air of the Hanford area are reported. (JGB)

11253 (JPRS-62618) TRANSLATIONS ON ENVIRONMENTAL QUALITY. Number 45. Translation of Monographs From Various Journals (31 Jul 1974). 32p. NTIS $3.25.

Contents include: seven Baltic states take action against sea pollution; antipollution measures in the Black Sea; insecticides, detergents, mercury called serious threats; Colombia national government promotes nature conservation; editorial criticizes indiscriminate sale of animals abroad; commission to study air pollution; excessive killing of alligators protested; litter causes pollution on Duarte highway; commission to study pollution of lakes Maracaibo, Valencia; lake dwellings must be eliminated; coastal pollution in Lebanon; atomic fallout in Leopoldshafen reported. (GRA)

11254 (NVO-410-27) OPERATION ARBOR. On-Site Radiological Safety Report, July 1973–June 1974. Eubank, B. F.; Mullen, O. W. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, Nev. (USA)). Aug 1974. Contract AT(26-1)-410. 22p. Dep. NTIS $4.25.

ARBOR was the name assigned to the series of underground nuclear experiments conducted at the Nevada Test Site from July 1, 1973, to June 30, 1974. This report covers the tests publicly announced by the United States Atomic Energy Commission, including Husky Ace Event, Latir Event, and Ming Blade Event. Remote radiation measurements were taken during and after each nuclear experiment by a telemetry system. Monitors with portable radiation detection instruments surveyed reentry routes into ground zeroes before other planned entries were made. Continuous surveillance was provided while personnel were in radiation areas and appropriate precautions were taken to protect persons from unnecessary exposure to radiation and toxic gases. Protective clothing and equipment were issued as needed. Complete radiological safety and industrial hygiene coverage was provided during drilling and mineback operations. Telemetered and portable radiation detector measurements are listed. Detection instrumentation used is described and specific operational procedures are defined. (auth)

11255 (TT-72-52008) EXPERIENCE WITH RADON CONTROL IN MINING. Bykhovskii, A. V.; Chesnokov, N. T.; Pokrovskii, S. S.; Khorev, G. N.; Yugov, P. I. 1974. Translation of Opyt Borby s Radonom pri Vedenii Gornykh Rabot, Moscow, 1969. 198p. NTIS $5.50.

Topics discussed are: radon as a factor of radiation hazard in mining operations, mining-geological characteristics of uranium ore mines, radon content in mines and methods of its determination, methods of reducing radon emanation, mine ventilation, controlling entry of radon into mine air, measures for reducing the concentration of aerosols in mine air, and control of working conditions in mines. (GRA)

11256 RADIOACTIVE STRONTIUM ISOTOPES IN THE ATMOSPHERE. Daniel, P. Y. Fayetteville, AR; Univ. of Arkansas (1974). 112p. University Microfilms Order No. 74-28,067.

Thesis (Ph. D.).

The $^{89}Sr/^{90}Sr$ ratio variation was studied following the 12th, 13th, and 14th Chinese tests of November 18, 1971, January 7, 1972, and March 18, 1972, respectively. A tropospheric cycling effect was observed following the 12th and 14th Chinese tests. Tropospheric cycling was not indicated in the radiostrontium data following the 13th Chinese test due to the scarcity of rainfall following this test; however, particle data clearly indicated the cycling of fresh debris. The presence of fresh debris following the French test series of the summers of 1970 and 1971 which were conducted at Mururo Island (22°S, 138°W) was clearly indicated. No indication of fresh debris was observed in rains collected at Fayetteville, Arkansas, or Ankara, Turkey, following French testing during June and July 1972. The mean tropospheric residence time was calculated following the 12th and 13th Chinese tests. A mean residence time of $7.5^{+3.5}_{-1.5}$ days is indicated for the 12th test. A somewhat longer time of 16 days, which is in good agreement with the value of 12 ± 3 days estimated from particle data, was determined following the 13th Chinese test. These values are in good agreement with the value of 10 days obtained earlier. The value of 16 days is also in good agreement with the values of 17 and 18 days calculated from $^{210}Bi/^{210}Pb$ ratios for February 2-3 and February 5-6, respectively. The mean tropospheric residence times determined from $^{89}Sr/^{90}Sr$ ratios, τ(Sr), were compared with the mean residence times determined from long-lived radon daughters following the 14th Chinese test of March 18, 1972. The values of τ(Sr) were also determined for several rains collected at Ankara, Turkey, (40°N, 33°E) and one rain collected at Tokyo, Japan, (34°N, 135°E). The τ(Sr) and τ(F) (calculated from $^{210}Po/^{210}Pb$ ratios) values were essentially concordant except for three cases: May 1, July 3 (where the τ(Sr) values from Fayetteville and Ankara rains were concordant), and March 28. For June 19 no τ(E) (calculated from $^{210}Bi/^{210}Pb$ ratios) or τ(F) (calculated from $^{210}Po/^{210}Pb$ ratios) were reported, but the τ(Sr) values calculated from Fayetteville and Tokyo rains were concordant. The trend for the τ(Sr) values to be greater than the τ(F) values can possibly be attributed to the mixing of air masses. (Diss. Abstr. Int., B)

Soil

11257 (CEA-CONF-2681) STUDY AND REPRESENTATION OF THE TRANSPORT OF Sr IN A ONE-DIMENSIONAL FLOW IN POROUS MEDIA. Brissaud, F.; Couchat, P.; Gayraud, J. P. (Montpellier-2 Univ., 34 (France); CEA Centre d'Etudes Nucleaires de Cadarache, 13 – Saint-Paul-les-Durance (France). Service de Radio-Agronomie). 1974. 10p. (In French). (CONF-740970-1). Dep. NTIS (U. S. Sales Only) $4.00.

From colloquium of the association of hydrology; Montpellier, France (16 Sep 1974).

Transport of strontium in a shaly sand was studied with a methodologic objective: how the exchange process must be taken into account to provide convenient numerical solutions of cation transport in porous media. Exchanges of strontium between sand and aqueous solution were determined from batch sorption tests and from displacements in sand columns; adsorption-desorption hysteretic isotherms designed the exchange equilibrium. Experiments in columns were performed for various initial concentrations in tracer. Numerical simulations using LAPIDUS and AMUDSON'S equilibrium model, with second degree polynomial approximations of adsorption-desorption isotherm, fit conveniently the experimental data; they demonstrate that the equilibrium relations to be considered are those derived from column tests. (FR)

11258 (FRNC-TH-505) TRITIUM, ^{131}I, AND ^{90}Sr STUDY OF DISPERSION AND PHYSICO-CHEMICAL EXCHANGES IN SATURATED POROUS MEDIA. Gayraud, J. P. (Montpellier-1 Univ., 34 (France)). Dec 1973. 86p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis.

Having been checked and proved to be a good water tracer, tritium was used to determine the dispersive properties of three porous materials: a purely siliceous sand (Fontainebleau sand), a chalky sand containing very little clay (Montpellier sand) and a very clayey sand (mixture of Fontainebleau sand and soil). The physico-chemical exchanges of two different elements, ^{131}I and ^{90}Sr, with these three porous media were studied. ^{131}I used in the form of anion exchanges very moderately, whereas ^{90}Sr in cation form exchanges without difficulty. Exchanges between ^{90}Sr and Montpellier sand were studied quantitatively and the results showed irreversibility of the exchanges and histeresis of desorption with respect to adsorption. A digital model of tracer migration in a one-dimensional flow was established. It can be used to determine the migration of strontium from the dispersion coefficient and from adsorption and desorption relationships between the solid and liquid phases. (FR)

11259 (INIS-MF-1031) CONNECTION BETWEEN STRONTIUM-90 AND VARIOUS FRACTIONS OF THE ORGANIC SUBSTANCE OF SOILS. Pavlotskaya, F. I.; Arnautov, G. N.; Blokhina, M. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1973. 20p. (In Russian). INIS.

An attempt is made to explain the character of the distribution of radioactive Sr, Ca, Fe, Al, and organic C among the individual fractions of organic substances of the soil and to explain the dependence between the results obtained. The data obtained on the character of the distribution of ^{90}Sr among different groups and fractions of organic substances of the soil and the form of occurrence in these fractions led to the conclusion that ^{90}Sr is present in soils basically not in the form of individual compounds with organic substances but in the form of complicated complexes. (tr-INIS)

11260 (ORNL-tr-2789) STUDY OF THE INTERACTION OF WASTES WITH THE GEOLOGICAL MATERIAL SUBSURFACE DEPOSITORIES AND DEVELOPMENT OF METHODS OF PREPARATION OF WASTES FOR DISPOSAL. Spitsyn, V. I.; Balukova, V. D. 1972. Translated from pp 7-10 of Proceedings of Science-Technical Conference Held in Kolobzheg, Poland, October 2–7, 1972. Vol. 2. 8p. Dep. NTIS $4.00.

The process of liquid radioactive waste disposal into porous water-bearing layers of deep formations is accompanied by a series of physicochemical processes in the geological environment of the storage site. An evaluation of such processes and their consequences should be performed parallel to the hydrogeological studies of the geological depositories. An entire series of studies necessary for a direct characterization of the material of the layer are described. Factors determining the basic conditions of compatability of the liquid wastes with the geological material are also considered. A series of methodical measures of experimental practice for the determination of the limits of compatibility of the stratal water and the wastes is described. Data on such determinations for a wide range of concentrations of various components of the waste materials are given for various levels of mineralization of the stratal water. On the basis of an analysis of the liquid radioactive wastes, as well as an examination of the properties, and behavior of individual components, the development of technological measures for the preparation of the wastes and their disposal into the formation by means of boreholes is presented. For individual conditions, the most advisable and suitable measures of chemical treatment of the operating zones of the

boreholes are described from the standpoint of maximum increase of their acceptability. (auth)

11261 INFLUENCE OF WATER-SOLUBLE DECOMPOSITION PRODUCTS OF GRASSY PLANTS ON THE ABSORPTION OF RADIOISOTOPES IN THE SOIL. Cherbotina, M. Ya.; Kulikov, N. V. (Urals Scientific Center, Sverdlovsk, USSR). Sov. J. Ecol. (Engl. Transl.); 4: 84-85(Nov 1973).

Translated from Ekologiya; No. 1, 102-103(1973).

The influence of water-soluble decomposition products of the above-ground mass of various grassy plants on the absorption of five radioisotopes (^{60}Co, ^{90}Sr, ^{91}Y, ^{137}Cs, and ^{144}Ce) in the soil was studied. It was found that in the presence of plant extracts the distribution coefficients of all the radioisotopes studied are sharply reduced in comparison with the control. This means that water-soluble substances of the decomposing above-ground mass of grassy plants reduce the absorption of radioisotopes in soil, thereby increasing their content in the liquid phase. (ERB)

Water

Refer also to abstracts 10600–10602 and 11276.

11262 (NP-20251) RELEASE OF RADIOACTIVE MATERIALS FROM NUCLEAR POWER PLANTS. Report No. 2. Dispersion Mechanisms, Transport Paths, and Concentration Factors for Radionuclides in the Cooling Water Recipient. Rygg, B. (Norsk Institutt for Vannforskning, Oslo). 10 Jan 1974. 36p. (In Norwegian). Dep. NTIS (US Sales Only) $5.00.

The discharge of radioactive materials in the cooling water from a nuclear power plant may involve consequences for the interests involved in the recipient and its organisms. Of special interest is the transport of radionuclides in water, sediments, and organisms to man. The most important elements are H, Na, P, Cr, Mn, Fe, Co, Zn, Sr, Mo, Ru, I, Cs and Ce. Metals with high affinity for organic material will be sorbed to sediments rich in organic material, while other elements will be enriched in algaes and arrive in the sediment through decay or excrement. Elements in particulate form will normally precipitate. Ions will generally not be enriched in sediments. Marine organisms may take up nuclides directly from the water and from food. The concentration factor is dependent on the chemical properties of the element and the physiology of the organism. The occurrence of elements in water and organisms in the Oslofjord district is poorly known and tables have therefore been derived from literature data to indicate the concentration factors to be expected. (NO)

11263 (TID-3917(Suppl.2)) MARINE RADIOECOLOGY: A SELECTED BIBLIOGRAPHY OF NON-RUSSIAN LITERATURE. Edmundson, E. Jr.; Schultz, V.; Klement, A. W. Jr. (Environmental Protection Agency, Boise, Idaho (USA); Washington State Univ., Pullman (USA). Dept. of Zoology). 1974. Contract AT(45-1)-2221. 57p. Dep. NTIS $5.45.

A bibliography of approximately 570 non-Russian references published during 1970 through 1974 is presented. The references are arranged alphabetically by first author. No indexes are included. (LCL)

11264 ACTIVITY RATIOS ^{234}U/^{238}U AND ^{235}U/^{238}U IN COASTAL MARINE SEDIMENTS. Joshi, L. U.; Ganguly, A. K. (Bhabha Atomic Research Centre, Bombay). pp 245-250 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The activities of ^{238}U, ^{235}U, and ^{234}U in the sediments along the west coast of India were measured and the ^{234}U/^{238}U and ^{235}U/^{238}U ratios were determined. The U isotopes were leached from the sediments with an ammonium carbonate solution, and the U was separated on an anion exchange column. After plating of the U on stainless steel, it was counted in a solid state detector. The results obtained were tabulated for various sites. These results showed that there is disequilibrium between ^{238}U and ^{234}U, but no disequilibrium was found for the other isotopic ratio. It was shown that the disequilibrium exists only on the surface of the untreated sediment particles. The validity of the hypothesis that during the transition of ^{238}U to ^{234}U the ^{234}U atoms are relocated into crystal defects was doubted. (JSR)

11265 EFFECT OF URANIUM ORE MINING ON ^{226}Ra CONTENT IN SURFACE WATER, REED AND FRESH-WATER FISH. Martinec, M. (KHS, Usti nad Labem (Czechoslovakia)). Cesk. Hyg.; 18: No. 10, 475-478(Dec 1973). (In Czech).

The content was studied of radium-226 in water, fish, and reed of a lake in order that the contaminating effect be ascertained of waste water discharged in geological survey for uranium or in uranium ore mining. With the progress of the survey the content of ^{226}Ra in water was observed to increase from 3 pCi/l to up to 20 pCi/l. A significant increase was also found for fish and reed. While a detailed analysis of the radionuclide content in carp shows the highest values of ^{226}Ra in the scales and in the bones, its concentration in flesh did not exceed the values given for the natural content of ^{226}Ra in foodstuff, i.e. 0.1 to 12 pCi/kg. (INIS)

11266 COMPARATIVE MARINE GEOCHEMISTRIES OF LEAD-210 AND RADIUM-226. Bruland, K. W.; Koide, M.; Goldberg, E. D. (Univ. of California, San Diego, La Jolla). J. Geophys. Res.; 79: No. 21, 3083-3086(20 Jul 1974).

The ^{226}Ra and ^{210}Pb concentrations in the Gulf of California and eastern North Pacific seawaters appear to be governed by the extents of upwelling and by the consequential biological productivities. The residence times of ^{226}Ra and ^{210}Pb in the highly productive Gulf of California surface waters are calculated to be a few months and less than a month, respectively, on the basis of upwelling rates. (auth)

Ecosystems and Food Cycles

Refer also to abstracts 11581, 11691, 11696, 13505, 13506, and 13512.

Radiometric Techniques

Refer also to abstracts 11252, 11411, 11420, 11422, 11423, and 11459.

11267 (PB-232119) INVESTIGATION OF THE WATER QUALITY AND PRODUCTIVITY OF POLSON BAY, FLATHEAD LAKE, MONTANA. Completion Report. Gaufin, A. R. (Montana State Univ., Bozeman (USA)). 1974. 17p. (MUJWRRC-48; W-74-07717; OWRR-A-043-MONT(1)). NTIS $3.00.

Zooplankton and phytoplankton collections were taken in Polson Bay at the lower end of Flathead Lake, MT, and a biomass estimate obtained. Exchange of nutrients with bottom sediments was measured, particulate matter in the water was analyzed for carbon and ash-free dry weight, and the gross primary productivity of Flathead Lake was measured by means of the carbon 14 method. Thermal stratification occurred at only a few locations in Flathead Lake. Nutrients and dissolved solids, although normally at low concentrations, were usually sufficient to support the growth of phytoplankton. Most components increased in concentration during the summer months. Coliform were almost non-existent in Polson Bay. (NTIS)

11268 DETERMINATION OF INDUCED RADIOACTIVITY LEVEL IN THE AIR UNDER THE EFFECT OF BREMSSTRAHLUNG RADIATION OF HIGH ENERGY. Milshtein, R. S.; Tarov, K. G. (Moscow Scientific Research Inst. of Roentgen-Radiology). Med. Radiol.; 19: No. 11, 49-53(Nov 1974). (In Russian).

The method of determining the level of induced radioactivity in the air, steam and aerosols under the effect of bremsstrahlung radiation of high energy is described. The following values of the specific induced activity for procedure rooms with the air space of 120 m^3 and betatron parameters of 200 Un. SGSE for radiation dose, and 30 Un. SGSE/min for dose rate are: in aerosols, 2.2 10^{-18} c/l, in water steam and air, 4.10^{-13} c/l and gases of the air, 1.1 10^{-11} c/l. (auth)

11269 APPROPRIATE CHOICE OF RADIO-ISOTOPES AND THEIR ACTIVITY FOR HYDROGEOLOGICAL INVESTIGATIONS ACCORDING TO MODEL MEASUREMENTS. Makowski, J. (Polska Akademia Nauk, Gdansk. Instytut Budownictwa Wodnego). Geol. Jahrb., Reihe C; No. 2, 329-337(1972). (In German).

6 figs.; 6 refs.

Hydrogeological and hydrotechnical investigations using radioactive tracer solutions have met with serious difficulties, concerning the choice of adequate radioisotopes to be used in the solution and even more to the selection of appropriate values of minimum radioactivity, necessary to carry through the studies. The attempt made in Poland to develop a standard model design for such preliminary investigations to find fully comparable factors for different radioisotopes to be used in tracer solutions with different assumed physico-chemical characteristics of soil and hydraulic pattern is described. Tests were carried out on the basis of this model in columns of various lengths, which resulted in an experimental equation expressing in a simple form the changes in concentration of the radioactive tracer solution along with its flow path. The sole exponential coefficient of this equation, gives the total characteristics of the dispersion factors, depending in turn on the type of radioisotopes used, the character of flow and the physico-chemical properties of soil and water medium. (INIS)

11270 YADERNAYA VULKANOLOGIYA. (Nuclear Volcanology). Cherdyntsev, V. V. Moscow; Nauka (1973). 208p. (In Russian).

145 refs.

This is the first review published in the world on nuclear volcanology—on the behavior of radioactive isotopes and their decay products in volcanic processes in which substances are released from the interior of the earth. Radioisotopes are of special interest in this connection because of their being in a state of radioactive equilibrium when in the depths of the earth. With this group of isotopes the laws of their distribution on the Earth's surface can be completely clarified. Considerable experimental material collected in recent years, largely from Soviet scientists, permits establishing a series of similar laws significant not only for volcanology but also for the study of properties of the upper mantle and formation of the earth's crust, of volcanic deposits on continents, and of the Pacific Ocean. (tr-auth)

11271 EFFECT OF ORE PROPERTIES AND MEASUREMENT GEOMETRY ON THE VALUE OF ACTIVATION EFFECT OF FAST NEUTRONS IN THE ^{28}Si (n,p) ^{28}Al REACTION. Shishakin, O. V.; Taushkanov, A. P.; Teben'kov, A. A. (Vsesoyuznyj Inst. Razvedochnoj Geofiziki, Kazakhskij Filial, Alma-Ata (USSR)). pp 267-278 of Problems of Ore Geophysics in Kazakhstan. Alma-Ata; Kazakhskij Filial, Vsesoyuznyj Inst. Razved. Geofiziki (1973). (In Russian).

10 refs.; 2 figs.; 2 tables.

The results of experimental and theoretical studies of the effects of the composition, humidity, and density of the ore and the borehole diameter on the value of registered intensity of the γ radiation of ^{28}Al from the $^{28}Si(n,p)^{28}Al$ reaction during irradiation of the rocks with 14-MeV neutrons are reported. The substantial influence is the the dependence of the results of the activation logging with fast neutron-induced ^{28}Al on the diameter of the borehole and the ore density. With variation of the diameter of the borehole by no more than 8% and the ore density by no more than 10%, the introduction of corrections to the measurements is necessary because of these effects. (tr-auth)

11272 INVESTIGATIONS INTO THE TRANSLOCATION OF SOIL PARTICLES IN THIN SURFACE LAYERS. Gorskij, Yu. B.; Kujda, V. I.; Pikus, S. A. pp 182-187 of Isotope and Nuclear Radiation Application in Agriculture. Section 2. Isotope Application in Crop Science and Agriculture. Moscow; Atomizdat (1971). (In Russian).

From all-union scientific-technical conference "20 years of production and isotope and nuclear radiation application in national economy of the USSR"; Minsk, USSR (7 Oct 1968).

A radioautographic method was developed by means of which it was possible to determine the displacement of soil particles with a sufficiently high accuracy without disturbing the integrity of the soil layer under study. In this method, modeling of the soil particles was performed directly by sources of gamma radiation introduced into the soil layer under study. The radiation sources were prepared from cobalt wire 0.9 mm in diameter, which were tagged with radioactive cobalt-60 having a half-life of 5.27 years. The sources were introduced into the soil layer under study, and their positions were fixed on x ray film placed on the soil surface. From two films on which the position of the radiation source is fixed before and after passage of a tool or plow, the displacement of soil particles in three directions is determined, that is, the whole picture of the displacements is obtained. (tr-INIS)

11273 PARAMETERS AND OPERATING CONDITIONS OF BOREHOLE PULSED NEUTRON GENERATOR FOR WELL-LOGGING AT BAUXITE DEPOSITS. Shishakin, O. V.; Taushkanov, A. P. (Vsesoyuznyj Inst. Razvedochnoj Geofiziki, Kazakhskij Filial, Alma-Ata (USSR)). pp 279-288 of Problems of Ore Geophysics in Kazakhstan. Alma-Ata; Kazakhskij Filial, Vsesoyuznyj Inst. Razved. Geofiziki (1973). (In Russian).

8 refs.

On the basis of experiments carried out in 1969 to 1970 on models and in exploratory boreholes the requirements are determined for a borehole, pulse neutron generator (yield, stability, selection of a monitor) and its mode of operation in studying boreholes for bauxite deposits. It is shown that in order to determine with sufficient accuracy Al and Si in bauxites by a twofold activation survey run on ^{28}Al with the use of a radioisotope source and a fast neutron generator the neutron yield from the generator must be at least 10^8 neutrons/sec. It is established that the most suitable material for monitoring the pulse neutron flux in the neutron borehole generator is a cylindrical detector made of an oxygen-containing plastic in which activation of oxygen from the reaction $^{16}O(n,p)^{16}N$ is used for neutron counting. (tr-auth)

11274 USE OF RADIOACTIVE DECAY OF POTASSIUM FOR THE DETERMINATION OF THE AGE OF ROCKS BY MASS SPECTROMETRY. Balogh, K. (MTA Atommagkutato Intezete, Debrecen, Hungary). Izotoptechnika; 17: No. 9-10, 477-479(1974). (In Hungarian).

From the ^{40}K and ^{40}Ar content of rock samples their age could be determined. Argon is determined by isotopic dilution analysis. (auth)

11275 AGE OF ACCESSORY URANIUM-CONTAINING MINERALS OF THE NORTH CAUCASUS. Afanas'ev, G. D.; Zykov, S. I.; Stupnikova, N. I. (Inst. of the Geology of Ore Deposits, Petrography, Minerals, and Geochemicals, Moscow). Dokl. Akad. Nauk SSSR; 215: No. 6, 1462-1465(21 Apr 1974). (In Russian).

Calculations for the first experimental data on pitchblende samples indicate that the actual age of formation of these deposits lies in the limits from 343 ± 30 down to 325 ± 15 million years and probably has the value 335 ± 10 million years which corresponds to the lower Carboniferous. Micas of porphyroid granite granodiorite give a K/Ar age from 310 to 325 million years, and an Rb/Sr age of 315 million years. Carboniferous formations were determined radiologically for only two samples. The analysis results indicated a much later time for their formation (probably in the lower Permian). Their Ar age varies in the limits from 280 to 260 million years. (JSR)

Site Surveys

Refer also to abstracts 11251 and 11299.

11276 (BNL-50420) EXPERIMENTAL EUTROPHICATION OF TERRESTRIAL AND AQUATIC ECOSYSTEMS. First Annual Report of the Upland Recharge Project. Woodwell, G. M.; Ballard, J.; Small, M.; Pecan, E. V.; Clinton, J.; Wetzler, R.; German, F.; Hennessy, J. (Brookhaven National Lab., Upton, N. Y. (USA)). Feb 1974. Contract AT(30-1)-16. 29p. Dep. NTIS $4.00.

Results are reported from studies on ground water velocity in BNL aquifers. Measurements were made in monitoring wells and following the addition of a dye tracer. (CH)

11277 (BNWL-1711) LYSIMETER EXPERIMENT DESCRIPTION AND PROGRESS REPORT ON NEUTRON MEASUREMENTS. Hsieh, J. J. C.; Brownell, L. E.; Reisenauer, A. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1973. Contract AT(45-1)-2130. 64p. Dep. NTIS $5.45.

Two large lysimeters were installed in the soil of the Hanford Reservation to gather data on the accumulation and penetration of meteoric water. The construction details of this experiment are described. The soil hydraulic characteristics and data collected for the first 6 months are included. (auth)

11278 (BNWL-SA-4960) USE OF CRITICAL PATHWAY MODELS AND LOG-NORMAL FREQUENCY DISTRIBUTIONS FOR NUCLEAR FACILITIES SITING. Waite, D. A.; Denham, D. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA). 1974. Contract AT(45-1)-1830. 16p. (CONF-741210-3). Dep. NTIS $4.00.

From symposium on siting of nuclear facilities; Vienna, Austria (9 Dec 1974).

The application of exposure pathway data and log-normal distribution analysis techniques are discussed. Applications in siting criteria for a centrifuge enrichment facility are described in which data available on Pu transport through the environment were used. The same procedures are applicable for any contaminants, radioactive or nonradioactive, or facility type that one might encounter. Where many contaminants are present in gaseous and liquid effluent streams, the process of constructing exposure pathways and collecting environmental concentration data may be more laborious, but still informative and advisable. Use of existing regional environmental surveillance data and past knowledge of contaminant transport characteristics makes the process of eliminating non-critical contaminants and media relatively quick so that further investigations of critical pathways and contaminants can be emphasized. Thus when contamination is released to the environment, due either to the planned disposal of wastes or to unplanned releases, siting selection will have been made to minimize the environmental consequences. (CH)

11279 (BNWL-SA-5193) MINERAL WEATHERING IN SOILS OF MIXED BASALTIC-FELSIC PARENT MATERIALS OVER BASALTIC BEDROCK. Routson, R. C.; Wildung, R. E.; Garland, T. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 7 Oct 1974. 17p. (CONF-741121-2). Dep. NTIS $4.00.

From annual meeting of the American Agronomy Society; Chicago, Illinois, USA (10 Nov 1974).

Mineral weathering of primary rock forming minerals by aggressive soil solution from the CO_2 produced by the respiration of organisms is the probable control on the composition of spring water at the Hanford Arid Lands Ecology Reserve (ALE). Water compositional differences from waters draining acid parent materials can be explained by the weathering of basic parent material minerals. The weathering of the basic mineral probably controls the water's composition even though both acidic and basic parent material are present in the soils of the watershed. (auth)

11280 (CONF-741055-1) CHARACTERIZATION OF PLUTONIUM IN SURFACE SOILS FROM AREA 13 OF THE NEVADA TEST SITE. Tamura, T. (Oak Ridge National Lab., Tenn. (USA)). 1974. 19p. Dep. NTIS $4.00.

From plutonium information conference; Las Vegas, Nevada, USA (8 Oct 1974).

Total Pu was determined in nine surface soil samples (0 to 5 cm) from area 13 in the Nevada Test Site (NTS). Particle size segregation was performed, and each particle size fraction of seven samples was analyzed for Pu. The coarse silt fraction (53 to 20 μM) contained the highest percentage of Pu in the soil (about 65%). Evidence of erosional translocation of Pu was observed in one of the samples, and corroborative evidence was noted in describing the soil type. Tests with 8 M nitric acid showed that about 13% of the Pu was leached from the NTS sample and in 0.1 M citric acid, about 1% of the Pu was extracted. Implications of these results on the transport of Pu are discussed. (auth)

11281 (GSF-R-87) HYDROLOGICAL AND HYDROGEOCHEMICAL INVESTIGATIONS IN THE ASSE REGION NEAR WOLFENBUETTEL. Frank, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Radiohydrometrie). Feb 1974. 208p. (In German). INIS.

41 figs.; 18 tabs.; 115 refs.; with app. With abstract.

Hydrogeological and hydrochemical investigations were carried out at the Asse mountain chain southwest of Wolfenbuettel (Lower Saxony) and in its immediate surroundings in connection with the ultimate storage of radioactive wastes in the salt mine Asse II. Particular attention was given to the hydrological connection between the local salt water bearing cap rock of the Zechstein salt material and the fresh water bearing ground water layers of the supercap strata. In order to clarify the connections, extensive analyses of waters of hydrological treatments (springs, fountains, receiving streams) at the Asse were evaluated and the significance of the different factors influencing the groundwater chemistry discussed. The results enable a statement to be made on the safety of a permanent sealing off of the stored radioactive wastes from the biocycle. (GE)

11282 (IA-1299) OFFSHORE BARS AT ASHDOD, THEIR TOPOGRAPHY AND SEASONAL BEHAVIOR, AND THEIR INDICATIVE RATIOS. Striem, H. L. (Israel Atomic Energy Commission, Tel Aviv). Jul 1974. 35p. Dep. NTIS (US Sales Only) $4.75.

In planning coastal installations such as those needed for a nuclear power plant, the topography and behavior of the offshore bars should be considered. Along Israel's sandy southern Mediterranean coast, it was found that there is usually one main offshore submarine bar of a significant topography that includes broad trunk sections alternating with narrowing branches. The trunks are linked to the inshore by regularly recurring submarine spurs. The bars usually have skew profiles reflecting their seasonal movement towards the shore in the summer and seawards in the winter. It was found that the ratios between certain bar parameters are indicative of the geomorphic condition of the bar. (auth)

11283 (LA-UR-74-1596) PROPOSAL TO DESIGNATE LAND AREAS OF THE LOS ALAMOS SCIENTIFIC LABORATORY AS A NATIONAL ENVIRONMENTAL RESEARCH PARK. Hanson, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 21p. (CONF-741053-1). Dep. NTIS $4.25.

From national environmental research park symposium; Idaho Falls, Idaho, USA (22 Oct 1974).

The broad goal of the proposed Los Alamos Environmental Research Park would be to provide an opportunity for qualified scientists of several disciplines to make use of the site for research to help determine how man can live in balance with nature, while at the same time enjoying the benefit of his technologies. Los Alamos Scientific Laboratory (LASL) has a number of major nuclear and chemical facilities that provide stresses on the environment similar to those produced by commercial plants, and which require integrated approaches for proper evaluation of their environmental importance. (CH)

11284 (NP-20255) SOME ECOLOGICAL MEASUREMENTS OF THE CAPE FEAR RIVER. Hobbie, J. E. (North Carolina State Univ., Raleigh (USA)). [nd]. 123p.

Ecological measurements were made on the Cape Fear River and adjoining oceanic waters from March 1969 until February 1970. Salinities, temperatures, oxygen concentrations, algal populations, zooplankton populations, larval fish and adult fish populations, and benthic organism numbers were measured. (auth)

11285 (UCRL-51685) THREE-DIMENSIONAL SUBSURFACE DELINEATION VIA A NOVEL METHOD FOR DETERMINING THE SUBSURFACE ELECTRICAL PROFILE. Lytle, R. J.; Bevensee, R. M.; Lager, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Oct 1974. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

The combination of a standard experimental procedure (four-probe electrical resistivity), a novel analytical technique (probabilistic potential theory), and a powerful inversion algorithm (optimization/generalized linear inverse) is proposed as a method for determining the subsurface electrical profile. Four-probe electrical measurements can yield electrical profiles which, in the light of known geologic information about the site, can be related directly to subsurface structure. However, the reduction of field data from such measurements heretofore has generally been successful only for the mathematically nice situations (e.g., horizontal or vertical stratification). For the more complicated case of general subsurface structure, the presently available analytical methods rapidly become unwieldy, computer-limited, or cost-ineffective. The analytical procedure proposed here should overcome these limitations and permit the efficient solution of complicated problems of subsurface structure. It is proposed that the feasibility of the procedure be tested by analysis of field experiments in conjunction with scale-model laboratory experiments to validate the algorithms for general structure. The procedure should have great practical value in a wide variety of applications: hydrology, location and definition of the shape and extent of underground resources (e.g., geothermal reservoirs, ore bodies, or deposits of coal, sand, or gravel), faultline definition, and monitoring of changes in subsurface conditions (e.g., as in earthquake studies, in situ coal gasification, and burn-front studies of oil-shale gasification). (auth)

11286 (UCRL-51689) SOC73, A ONE-DIMENSIONAL WAVE PROPAGATION CODE FOR ROCK MEDIA. Schatz, J. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1974. Contract W-7405-eng-48. 35p. Dep. NTIS $4.00.

SOC73 is a highly modified version of SOC, a computer code that numerically simulates mechanical wave propagation in geologic media. Innovation in SOC73 lies mainly in the constitutive modeling of solid media. New models have been introduced in which the pressure-volume behavior and the behavior of brittle, ductile, and tensile failure are more continuous and representative of laboratory and field observations than before. There are also new methods of low-pass compressional filtering and high-pass distorsional filtering that are more physically and numerically satisfying. Finally, the concept of failure-associated strain has been introduced. It allows an estimate of the damage caused to the medium by an inelastic stress wave. (auth)

11287 GEOHYDROLOGY OF THE BURIED TRIASSIC BASIN AT THE SAVANNAH RIVER PLANT. Marine, I. W. (E. I. du Pont de Nemours and Co., Aiken, SC). Ground Water; 12: No. 2, 84-96 (1974).

At the Savannah River Plant near Aiken, South Carolina, as at other locations where there are chemical separations plants for the processing of nuclear fuels, the high-level radioactive wastes are stored in concrete and steel tanks buried just beneath the surface of the ground. This waste is of such activity and longevity that it cannot be dispersed into the environment, but it must be contained for periods of time extending at least into hundreds and perhaps thousands of years. One concept for the terminal containment of this waste is to store it in excavated chambers within the bedrock, which is covered by about 1000 feet of Coastal Plain sediments at the plantsite. As part of the safety evaluation of this concept, the geology and hydrology of both the Coastal Plain sediments and the bedrock have been studied. However, intensive investigation of bedrock waste storage has now been deferred pending more detailed evaluation of alternative concepts of waste storage and management. In the studies completed, a buried Triassic basin that might have potential for waste storage was discovered beneath the southern third of the plantsite. Investigation into the characteristics of this basin was started in 1971. This was not an engineering or design study but was aimed at understanding the geohydrology of the Triassic basin to determine its compatibility with the

safe storage of waste. Seismic surveys, gravity and magnetic surveys, and the drilling of several exploratory wells indicate that the Triassic basin is about 30 miles long, 6 or more miles wide, and perhaps 5300 feet thick. One well penetrated the Triassic border, a second was in the center of the basin, and a third investigated an inferred intrabasin fault. The rock is predominantly mudstone of very low permeability with a few lenses of poorly sorted gritty sand. The water yield of all the exploratory wells is extremely low, and water-transmitting fractures are virtually nonexistent. (auth)

Thermal Effluents

Refer also to abstracts 11241 and 11243.

11288 (AD-771940) DIGITAL COMPUTER SIMULATION OF THERMAL EFFLUENT DISPERSION IN RIVERS, LAKES, AND ESTUARIES. Codell, R. B. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 5 Nov 1973. 228p. (RS-TR-73-16). NTIS $5.75.

The purpose of this work was to illustrate that the dispersion of effluent from thermal power plants discharging into bodies of water could be realistically simulated on a digital computer. The basic equations for the conservation of mass, momentum, and thermal energy in three dimensions were simplified and vertically integrated into different forms depending on whether the discharge was of the thermally stratified or well mixed type. Numerical algorithms were devised to solve the finite difference representations of the simplified conservation equations within the limits of present day digital computers. Extensive linear stability analysis was performed to assure the validity and stability of the numerical solutions. The stratified flow model assumes two distinct layers, an upper thermal layer and a lower ambient layer either stagnant or flowing. The nonstratified model is useful for cases of large bodies of water where there is severe mixing and no appreciable stratification. In both models, the boundaries of the computational grid are completely general and are able to simulate arbitrary shorelines and discharge configurations. (auth)

11289 (COM-73-11294) CHARACTERISTICS OF CONDENSER WATER DISCHARGE ON THE SEA SURFACE (CORRELATION OF FIELD OBSERVATIONS WITH THEORY). Index No. 73-312-CCS. Doret, S. C.; Harleman, D. R. R.; Ippen, A. T.; Pearce, B. R. (Massachusetts Inst. of Tech., Cambridge (USA)). 26 Jun 1973. 128p. (MITS-G-73-12). NTIS $4.50.

Field measurements of the condenser water discharge plume at the Pilgrim Nuclear Power Station were conducted during three survey periods between January and April 1973. Horizontal temperature profiles of the plume were obtained for two water depths. Vertical temperature profiles were obtained in the far field to establish the ambient water conditions for the various survey periods. Plume centerline temperature reduction versus distance and surface isotherm areas were determined from the field data. The field data collected was compared to an analytical model developed for prediction of the heat affected zone. (auth)

11290 (COM-74-11114) SEDIMENTATION OFF THE KEWAUNEE NUCLEAR POWER PLANT. Pezzetta, J. M. (Wisconsin Univ., Madison (USA)). Mar 1974. 69p. (WIS-SG-74-221). NTIS $6.50.

A comparative two-year study of the nearshore sedimentary environment of Lake Michigan was undertaken to provide basic information on the physical characteristics of the lake bottom and beach zone in the vicinity of the condenser cooling water discharge plume of the Kewaunee Power Plant located near Two Creeks, Wisconsin. Wave action and wind-driven currents are the principal mechanisms by which the sediments are redistributed along the littoral zone in a general southerly direction. Monitoring of the sediment field and adjacent shoreline after the plant is in operation should indicate whether the jet flow of discharged cooling water will adversely affect the natural sedimentary processes operative in the nearshore environment. (GRA)

11291 (COM-74-11120) MARINE STUDIES OF SAN PEDRO BAY, CALIFORNIA. Part III. Thermal Tolerance and Sediment Toxicity Studies. Soule, D. F.; Oguri, M. (University of Southern California, Los Angeles (USA)). Feb 1974. 115p. (USC-SG-1-74). NTIS $8.75.

This is the third in a series of marine studies of San Pedro Bay, California. Emphasis is on thermal tolerance and sediment toxicity studies. The six studies are titled: thermal effects and San Pedro Bay; preliminary observations on the lower minimum temperature requirements of the northern anchovy; effects of subnormal temperatures on some common Los Angeles harbor animals; the effect of various water temperatures on the survival and reproduction in Polychaetous annelids; tolerance of Littorina planaxis and L. scutulata to temperature changes (mollusca, gastropoda); and preliminary investigations of the effects of resuspended sediment on two species of benthic polychaetes from Los Angeles harbor. (GRA)

11292 (DEU-74-1(Rev.)) POWER ECONOMY AND ITS EFFECT ON THE ENVIRONMENT IN THE GERMAN FEDERAL REPUBLIC. Geiger, B.; Layer, G.; Peter, U.; Rudolph, M.; Schaefer, H. (Forschungsstelle fuer Energiewirtschaft, Muenchen (F.R. Germany); Technische Univ. Muenchen (F.R. Germany). Inst. fuer Energiewirtschaft und Kraftwerkstechnik). Sep 1973. 83p. (In German). INIS.

17 figs.; 16 tabs.; 27 refs.; with app.

The effects of conventional and nuclear power plants and combustion processes in industry, households, and traffic on the environment (air and water pollution, thermal pollution, noise, and the emission of hazardous substances) were investigated. The city of Munich is taken as an example to illustrate and discuss the pollution of a large city due to power generation and consumption. The appendix added to the study discusses the radiation exposure as a result of nuclear energy utilization. (GE)

11293 (NP-20252) INVESTIGATIONS OF WATER AND POLLUTION PROBLEMS WITH NUCLEAR POWER PLANTS. Results from the Oslofjord District for the Period 1971–1972. Haugen, I.; Nilsen, G. (Norsk Institutt for Vannforskning, Oslo). Jun 1973. 181p. (In Norwegian). Dep. NTIS (US Sales Only) $12.00.

The results of theoretical, field biological and experimental investigations carried out in 1972 as a continuation of the investigation of problems arising from nuclear power plants are presented. The effect of temperature on marine biology is discussed and it is shown that while the effects of local temperature increases can be positive, undesirable effects can also occur. The effects of the release of radioactive materials in the amounts to be expected are considered to be insignificant. The hydrography and topography of the Oslofjord district is described and discussed. Field investigations of plankton, algae, and benthic organisms are described and the results presented in tabular form, and experimental investigations with algae and plankton are reported. A brief summary of the fishery activity is included. (NO)

11294 (PB-210747) USE OF REACTOR COOLING WATER FROM NUCLEAR POWER PLANTS FOR IRRIGATION OF AGRICULTURAL CROPS. Project Completion Report. Boersma, L. L.; Barlow, E. W. R.; Rykbost, K. A. (Oregon State Univ., Corvallis (USA)). Apr 1972. DI-14-01-0001-1939. 109p. (WRRI-12; W-72-10807; OWRR-B-009-ORE(3)). NTIS $3.00.

Field tests were conducted with heat applied to the soil through underground pipes and crops grown under controlled conditions. Results obtained during three growing seasons have been summarized. A considerable variation in the response between years can be observed. This variation is in large part due to differences in climatic conditions during the three growing seasons. The results do indicate that for the growing conditions which prevail in the Williamette Valley, a yield increase from 30 to 40% may be expected for most crops grown. (GRA)

11295 (PB-221549) EFFECTS OF TEMPERATURE ON GROWTH AND REPRODUCTION OF AQUATIC SNAILS. Ecological Research Series. Van der Schalie, H.; Berry, E. G.; Mount, D. I. (Michigan Univ., Ann Arbor (USA)). Feb 1973. 175p. (EPA-R-3-73-021). GPO $2.35.

The effects of temperature on the following freshwater snails were studied: Lymnaea Stagnalis, L. Emarginata, Helisoma Trivolvis, H. Anceps, H. Campanulatum, and Physa Gyrina—all pulmonate 'pond' snails; one gill-breathing operculate (Amnicola Limosa); was also tested. Both growth and egg-laying were measured in temperatures ranging from 6 to 36 C. Gonad development was determined through serial paraffin sections; reproduction was measured in terms of egg-laying. The lymnaeids grow best at 18 C; egg production is better at 22 C. In contrast, the planoreids grow better under warmer conditions (about 25 C); however, when 30 C is reached growth may appear better but reproduction is inhibited. (GRA)

11296 (PB-224642) QUANTIFICATION OF AQUATIC ENVIRONMENTAL IMPACT OF ELECTRIC POWER GENERATION. Final Report. Gruhl, J. (Massachusetts Inst. of Tech., Cambridge (USA)). Apr 1973. 176p. (MIT-EL-73-004). NTIS $5.25.

Proposed is a method for creating, to the extent of their predictability, the proper and timely forecasts of the aquatic ecosystem consequences of electric power system operation. A procedure is developed and intended for use in quantifying the ecological sacrifices associated with a number of desirable regional dispatch schedules. With the use of this technique, either as an operational tool or as a simulation tool, associated with a given reliability

level, optimum scheduling schemes can be used to evaluate optimum dollar cost–environmental impact pairings. Essentially calculated is the change in desirability to man of the ecosystem. Predictive techniques are developed for the avoidance of mortalities due to thermotoxic synergisms. This project is primarily intended as a state-of-the-art survey of the research areas contributing to this area with particular attention paid to the precise modeling techniques available. However, a new method is presented for combining these inputs in a thorough and consistent manner to obtain a meaningful environmental impact measure. (GRA)

11297 (PB-227239) THERMAL TOLERANCES OF INTERIOR ALASKAN ARCTIC GRAYLING (THYMALLUS ARCTICUS). Laperriere, J. D.; Carlson, R. F. (Alaska Univ., College (USA)). Dec 1973. 42p. (IWR-46; W-74-03759; OWRR-A-041-ALAS(3)). NTIS $3.25.

Arctic grayling, Thymallus arcticus, captured from the Chena River in interior Alaska or artificially propagated from the sex products of fish from this population were tested for tolerance to elevated water temperatures. Most tests were conducted in recirculating temperature-controlled tanks with a few conducted as standard static bioassays. Median tolerance limit ranges were delineated for SAC FRY, young-of-the-year, fish larger than 10 cm, and fish larger than 20 cm. There is some evidence that the least sensitive life cycle stage is the young-of-the-year, which had a median tolerance limit above 24.5°C after acclimatization at 8.5°C ± 1°C. Equipment limitations did not allow acclimatization of all fish at the same temperature, however. Therefore, some changes in tolerance due to life cycle changes were somewhat masked by the effect of different acclimatization temperatures. (GRA)

11298 (PB-227367) MEASURES FOR THE RESTORATION AND ENHANCEMENT OF QUALITY OF FRESHWATER LAKES. (Environmental Protection Agency, Washington, D. C. (USA)). 1973. 249p. (EPA-430/9-73-005). GPO $2.85.

Background information is provided on lake environments followed by state-of-the-art information on remedial measures for enhancing and restoring the quality of lakes, ponds, and reservoirs as required by the legislation. Discussion of major lake problems is included in an appendix. (GRA)

11299 (PB-228037) COLUMBIA RIVER THERMAL EFFECTS STUDY, Volume 2. Temperature Prediction Studies. Environmental Protection Agency, Washington, D. C. (USA)). Jan 1971. 72p. NTIS $6.75.

Three numerical models have been adapted to predict temperatures in the main stem Columbia River, extending 750 miles from the Canadian border to the mouth of the river at Astoria, Oregon. These three models facilitate prediction of temperatures in the four hydraulic regimes which comprise the main stem Columbia in the United States. The models are: the weakly stratified reservoir model; the river-run reservoir model; and the estuary model. The computer software (programming) for the weakly-stratified reservoir model and the river-run reservoir model, as well as the necessary hydraulic, hydrologic, and meteorologic data, constitutes the Columbia River temperature model. (NTIS)

11300 (PB-232992) EARLY LIFE HISTORY AND FEEDING OF YOUNG MOUNTAIN WHITEFISH. Ecological Research Series Report. Stalnaker, C. B.; Grasswell, R. E. (Utah State Univ., Logan (USA). Dept. of Wildlife Science). Jan 1974. 56p. (EPA-660/3-73-019). GPO $0.95.

Early life history studies and development of culture methods of the mountain whitefish (Prosopium williamsoni) were conducted in the Logan River, and in the Utah State Research Laboratory and USU Fisheries Laboratory. Spawning was observed in the laboratory and the Logan River from mid-November to mid-December during dusk. At ambient river temperature from 1.7°–6.1°C eggs began hatching after 79 days and continued for 23 days. Total mortality to hatch of eggs from weekly collections from five areas was 92%. In the laboratory, at 7.2°C eggs began hatching in 52 days and continued for 23 days; at 8.9°C in 45 days and continued for 30 days. Larval whitefish from two areas showed differences in growth due to temperature experience. Growth was examined in the laboratory at 6, 9, and 12°C. A simple linear model for predicting growth was developed. (GRA)

11301 BENEFICIAL USE FOR THERMAL DISCHARGES. Cook, B.; Biswas, A. K. Ottawa; Information Canada (1974). vp. (In French and English).

The total peak thermal input to Canadian fresh and tidal waters is estimated to increase from 6.025×10^{10} BTU/hr in 1970 to 136.7×10^{10} BTU/hr in 2000 A.D. Approximately 80% of heat rejection to the environment in Canada is contributed by electrical power production. The effects of future large-scale heat release remain unknown. To date, nuclear power plants, operating at about 33% overall thermal efficiency, pose a greater threat in terms of thermal pollution than fossil-fuel plants, which can attain about 40% efficiency. In controlling thermal pollution from fossil and nuclear-fuel power plants, cooling ponds and reserviors, evaporative cooling towers and dry-cooling towers are the main alternatives to the once-through cooling process. However, considering the variables of relative ground area required, average condenser water requirement and consumption use, and capital investment, operating and maintenance costs, the once-through cooling process is the most economic as well as efficient way of dissipating residual heat. Environmental effects, costs, and benefits of alternative cooling systems are evaluated. It is concluded that the choice of beneficial use for thermal discharge is inevitably dictated by the particular situation. Many uses, such as ice control and snow-melting, are seasonal in nature and require that alternatives be found for off-seasons. Other uses, particularly industrial uses and district heating systems, require higher grade heat than that normally available in thermal discharge, and transportation of low grade heat to the user is generally a difficult and expensive proposition. In special cases, district heating may find a worthwhile application in Canada. Possibilities of developing cooling ponds as recreational facilities are worth pursuing in view of the increasing pollution of Canadian lakes and rivers, particularly around urban areas in southern Canada. Certain forms of thermal aquaculture and thermal agriculture hold good possibilities for Canadian application as they can extend the length of the producing seasons in some cases to a year-round venture. Furthermore, they can use land around power plants which is, under present safety regulations, barred to residential and urban development. Multipurpose energy use concepts should be seriously considered as part of the long term solution to the total pollution problem. Finding beneficial uses for waste heat is really only a short term stop-gap method of handling this problem. In addition, it does not seem possible that the beneficial uses can utilize all the vast quantity of thermal discharges from power stations. This is especially true for summer, when the need for thermal pollution alleviation is at a maximum, but the possibilities for beneficial uses of waste heat are minimal. (CH)

11302 ARE WET-TYPE COOLING TOWERS LESS HARMFUL TO THE ENVIRONMENT? Schiffers, A. (Rheinisch-Westfaelisches Elektrizitaetswerk A. G., Essen (F. R. Germany). Abt. Kraftwerksbetrieb). Energie; 26: No. 7/8, 228-234(Aug 1974). (In German).

6 figs.; 3 tabs.; 10 figs.

Topical problems relating to wet-type cooling towers and their effect on the environment are discussed. In conclusions, the author poses the question: How cumbersome are cooling towers really? (TK/CB)

11303 EFFECTS ON RIVERS OF HEATING AND WITHDRAWAL OF WATER. Boehnke, B. (Technische Hochschule Aachen (F. R. Germany). Inst. fuer Siedlungswasserwirtschaft). Wasserwirtschaft; 63: No. 11/12, 372-383(1973). (In German). 24 figs.; 2 tabs.; 16 refs.

Exemplary coverage is provided of temperature effects on physical and biological processes in a body of water. Critical values for O_2-content and temperature, possible heating-up margin, and cooling down function are given. Compensation of temperature effect by artificial oxygen supply (ventilation, weirs, cooling towers, nozzle injection is considered. Limits of fresh water cooling, water withdrawal by means of various cooling methods, and possibilities for future development with regard to costs and environmental protection are discussed. (auth)

11304 METHOD AND APPARATUS FOR PREVENTING THERMAL POLLUTION. Lahoud, J. A.; Orphal, D. L. (to Computer Sciences Corp.). US Patent 3,851,495. 3 Dec 1974. Filed date 5 Oct 1971. 6p.

Thermal pollution from industrial manufacturing and electric generation plants is avoided by incorporating in the water cooling system of such plants an underground water storage and heat dissipation space as formed by nuclear explosion. In a preferred embodiment, the system incorporates a wet type water cooling system (primarily because of its lower cost) and one or more nuclear chimneys below the level of the local aquifer or water table so that makeup water for water lost through evaporation in the wet type cooling unit is added by water draining or leaching to the nuclear chimney from the aquifer level. (Official Gazette)

Chemical Effluents

Refer also to abstracts 10511, 11244–11246, 11251, 11262, 11292, and 11693.

11305 (AECL-4612) AUTOMATED COLORIMETRIC METHOD FOR THE DETERMINATION OF PARTS PER BILLION OF SULFIDE ION IN WATER. Jarbo, G. J.; Mislan, J. P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1973. 13p. INIS.

A continuous flow colorimetric method for the determination of low level sulfide ion concentrations in water has been developed. The equipment used is relatively simple and readily available. The wide range of the method offers an analytical capability for monitoring plant effluents to keep within the stringent upper limits set by Government Environmental Agencies. (auth)

11306 (BNWL-SA-5062(Rev.)) PRECIPITATION SCAVENGING: SOME PROBLEMS, APPROXIMATE SOLUTIONS AND SUGGESTIONS FOR FUTURE RESEARCH. Slinn, W. G. N. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-1830. 83p. Dep. NTIS $7.25.

This report focuses on some problems associated with the collision efficiency for particles by drops, rain and snow scavenging, and scavenging in frontal and convective storms. It is suggested that the major uncertainties about the collision efficiency stem from the lack of appropriate laboratory data for submicron particles. A formula for the collision efficiency for particles by drops is presented which contains a revision of the contribution from interception. Because of uncertainties about the collection efficiency and raindrop size distributions, a gross approximation for the rain scavenging rate is suggested. Comparisons with field data lead to concern that simultaneous dry deposition may have seriously biased the data. A similar gross approximation is suggested for the snow scavenging rate, which is a case where even less is known about the collection efficiency. However a qualitative indication of its dependence on particle size and crystal form is presented. It is suggested that these formulae can be used to predict scavenging from plumes and clouds; however other problems appear. A major one is to account for the pollutant's modification in the atmosphere. For stable clouds information is also needed about the precipitation within the cloud and the pollutant's distribution with respect to horizontal inhomogeneities, especially in stable frontal storms. Scavenging by convective clouds is almost entirely dictated by the pollutants' trajectories near the storm. It is suggested that deeper studies of washout ratios will lead back to studies of scavenging rates. Finally, it is proposed that maximum scavenging rates be used for safety analyses. (auth)

11307 (BNWL-SA-5117) APPLICATION OF THE EPAEC SCAVENGING MODEL TO CALCULATIONS FOR INDUSTRIAL PLUMES. Hales, J. M.; Dana, M. T.; Wolf, M. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 10p. (CONF-741003-7). Dep. NTIS $4.00.

From precipitation scavenging conference; Champaign, Illinois, USA (13 Oct 1974).

The EPAEC computer code was developed to predict the rainout of gases from industrial plumes by natural precipitation. The primary motivation for creating this model was to account mathematically for reversible characteristics of gas absorption by rain, a phenomenon whose presence has been indicated by results of previous field studies. The model has been applied to a number of practical situations with apparant success. The extent of its practical utility as a predictive tool for applied atmospheric analysis is critically analyzed. (auth)

11308 (EPA-660/2-74-078) ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSES: ASSISTANCE PROJECTS, FY 73. Alford, A. L. (Southeast Environmental Research Lab., Athens, Ga. (USA)). Aug 1974. 31p. GPO $1.00.

The National Water Contaminants Characterization Research Program (now the Analytical Chemistry Branch) of the Southeast Environmental Research Laboratory identified and measured aquatic pollutants under eight projects in answer to requests for assistance. In most cases these analyses helped to solve, or at least to understand more clearly, the related pollution incident and in some cases provided evidence for enforcement of regulatory legislation. Under an additional project, analytical consultations were held as requested by various organizations concerned with pollution incidents. (auth)

11309 (LBL-3059) DEVELOPMENT OF A FEASIBLE PROCESS FOR THE SIMULTANEOUS REMOVAL OF NITROGEN OXIDES AND SULFUR OXIDES FROM FOSSIL FUEL BURNING POWER PLANTS. Clay, D. T.; Lynn, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-eng-48. 290p. Dep. NTIS $17.75.

Thesis. Submitted by D. T. Clay.

A dry solids process has been developed for the simultaneous removal of NO and SO_2 from power plant stack gases. A catalyst/absorbent in a net reducing flue gas effects the removal of SO_2 by absorption as ferrous sulfide or sulfate and the removal of NO by reduction to nitrogen or ammonia. The solid is regenerable; reaction with air produces a rich stream of SO_2 and ferric oxide. The SO_2 may be converted to a saleable H_2SO_4 and the solid is recycled to the process. The process is capable of greater than 90% removal of SO_2 and NO. The emissions of H_2, CO, and NH_3 are well below acceptable emissions levels. The concentration of the solids in the effluent stream is not significantly increased over normal flyash levels. There is no significant increase in the quantity of solids which must be disposed of. No flue gas cooling or reheating is required. There are no large storage vessels or slurry transport lines within the process. The regeneration process is thermally self-sufficient. Experiments in a flow-through fixed-bed reactor between 370–540°C have confirmed that the process reactions are feasible. Known calculational techniques were used to extrapolate the fixed-bed rate data to dispersed-phase contactor conditions. The rapid rates result in a relatively short contact time for the highly dilute dispersed-phase contactor. Similar experimental and calculational techniques were used to confirm that regeneration would be feasible at 680°C in a fluidized bed. An economic analysis of the process for a 1000-MW coal-fired power plant showed that it is quite competitive with currently existing wet-scrubbing processes which remove only SO_2. The process costs, including the H_2SO_4 plant, are $18.5/kW for the capital investment and 0.91 mills/kW-hr for the operating cost, with no credit taken for the H_2SO_4. (auth)

11310 (ORNL-EIS-74-70(Pt.1)) TRANSPORT OF HAZARDOUS SUBSTANCES THROUGH SOIL PROCESSES. Volume 1. Arsenic, Beryllium, Cadmium, Chromium, Copper, Cyanide, Lead, Mercury, Selenium, Zinc, and Others. Copenhaver, E. D.; Wilkinson, B. K. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 153p. Dep. NTIS $10.75.

This bibliography is intended for use by personnel concerned, either via research or management, with the disposal of hazardous wastes, other than sewage sludge, on land. It is the result of a search of recent literature and includes information on the transport, transformation, and soil retention of arsenic, asbestos, beryllium, cadmium, chromium, copper, cyanide, lead, mercury, selenium, zinc, halogenated hydrocarbons, pesticides, and other hazardous substances. The literature search focused on processes directly related to transport (adsorption, ion exchange, etc.) and documentation of the occurrence and extent of transport while specifically excluding topics such as uptake and translocation by plants, theoretical modeling, and effects on microorganisms and processes mediated by microorganisms. (CH)

11311 (ORNL-EIS-74-70(Pt.2)) TRANSPORT OF HAZARDOUS SUBSTANCES THROUGH SOIL PROCESSES. Volume 2. Pesticides. Copenhaver, E. D.; Wilkinson, B. K. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 277p. Dep. NTIS $17.00.

This bibliography is intended for use by personnel concerned, either via research or management, with the disposal of hazardous wastes, other than sewage sludge, on land. Information on the transport, transformation, and soil retention of a number of hazardous substances is presented in Volume 1. This volume contains citations on pesticides and detailed information on chemical nomenclature and structures of pesticides is appended to this volume. (CH)

11312 (ORNL-NSF-EATC-11) ECOLOGY AND ANALYSIS OF TRACE CONTAMINANTS. Progress Report, October 1973–September 1974. Fulkerson, W.; Shults, W. D.; Van Hook, R. I. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 181p. Dep. NTIS $12.25.

Progress is reported from studies on the environmental impact of trace amounts of toxic substances and the development of methods for reducing discharges of certain of these. The work is not specific to any one trace contaminant although much of the effort has been and continues to be focused on trace elements. However, work is also directed toward analyzing trace organic compounds in natural water, and research has recently been initiated on characterizing both the organic and inorganic constituents of materials from coal-conversion pilot plants. The research encompasses five areas: development and application of a unified transport model for trace contaminants; ecological research to characterize the translocation and accumulation of trace elements in the environment; measurements research to

improve analytical efficiency and capability; development of advanced aqueous abatement technology featuring recycle; and information flow and management. During this reporting period the work has revolved about four project themes: studies of the input of SO_2 to Walker Branch Watershed from neighboring fossil-fuel steam power plants and of the input and outflow of trace elements at this forested ecosystem at ORNL; studies of Pb, Cu, Cd, and Zn at the Crooked Creek Watershed near a lead smelting–mining complex in the New Lead Belt of southeastern Missouri; investigation of the transport and biological accumulation of mercury in the Holston River–Cherokee Reservoir system in Virginia and Tennessee; and analytical characterization of materials from various coal-conversion pilot plants. These project themes constitute realistic situations for testing of techniques and, in addition, provide an opportunity to obtain useful information on important pollution problems. (CH)

11313 INTERNATIONAL APPROACH TO THE MARINE POLLUTION PROBLEM. Waldichuk, M. (Fisheries Research Board of Canada, West Vancouver, B. C.). Ocean Manage.; 1: No. 3, 211-261(Nov 1973).

Attempts at international control of marine pollution commenced as early as 1926 in a proposal to limit oil pollution in the sea by a convention which failed to be ratified. The first successful Convention for the Prevention of Pollution of the Sea by Oil was adopted in 1954 and amended in 1962. An attempt will be made to expand the terms of this Convention at a Conference on Marine Pollution to be convened by the Inter-Governmental Maritime Consultative Organization in October 1973. It is planned to include other noxious substances than oil carried by ships, as well as ship-generated garbage and sewage. The Convention on the Dumping of Wastes at Sea, adopted in London on November 13, 1972, will be responsible for the control of marine pollution arising from dumping wastes at sea, where certain substances are prohibited from being dumped and others can only be dumped under close supervision. The International Law of the Sea Conference to be convened in Santiago, Chile, during April 1974, will attempt to introduce international control over other forms of marine pollution by legislative action. There are various inter-governmental bodies dealing with the scientific aspects of marine pollution, including the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the International Atomic Energy Agency, the Food and Agricultural Organization and the World Meteorological Organization. These bodies, along with others, formed the IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN Joint Group of Experts on the Scientific Aspects of Marine Pollution, which met for the first time in March 1969, and annually since then, to deal with scientific matters pertaining to marine pollution. The International Coordination Group on the Global Investigation of Pollution in the Marine Environment of the IOC met for the first time in April 1973 to coordinate a global approach to studying the marine pollution problem. Under the Integrated Global Ocean Station System, a pilot project to monitor oil pollution in the North Atlantic and contiguous seas has been initiated. There are a number of regional programs which might be incorporated into a global monitoring program, such as the North Sea and Baltic projects, coordinated under the International Council for Exploration of the Sea. National programs under the International Decade of Ocean Exploration will also be candidates for inclusion in global pollution studies. In addition, a number of non-governmental bodies such as the Scientific Committee on Oceanic Research and Scientific Committee on Problems of Environment of the International Council of Scientific Unions are addressing themselves to scientific issues of marine pollution. The solution of global problems of marine pollution can only be achieved through international legislative action combined with strong backing by scientific research and monitoring. Many national programs will have to be coordinated by an international mechanism probably under the aegis of IOC. In the final analysis, the problem of global pollution can only be solved by cooperation of states with control of pollution nationally first and then internationally second. (NL)

INSTRUMENTATION

Radiation Detection Instruments

General Detectors and Monitors

Refer also to abstracts 10505, 10577, 10586, 10588, 10590, 10843, 11479, 11744, and 12337.

11314 (AD-784412) PHOTOGRAPHIC METHODS IN NUCLEAR PHYSICS. Perfilov, N. A. Translated by B. Kingsley and V. Vaguine from Usp. Nauch. Fotogr.; 15: 52-66(1970). 22p. (FSTC-HT-23-1264-73). NTIS $4.25.

The so-called thick-layer plate method for registering nuclear particles and for analyzing nuclear reactions is reviewed and photoemulsions for nuclear studies and application for scanning and measurement are considered. (auth)

11315 (AED-CONF-74-331-001) NUCLEAR MEDICAL MEASURING UNIT WITH INTEGRATED SMALL COMPUTER FOR THE RECORDING AND ANALYSIS OF FUNCTION CURVES. Klement, V.; Nentwig, C.; Gettner, U.; Jordan, K. (Medizinische Hochschule Hannover (F. R. Germany). Abt. fuer Nuklearmesstechnik und Strahlenschutz). 1974. 7p. (In German). INIS.

From third annual meeting of the Deutsche Gesellschaft fuer Biomedizinische Technik; Hanover, Germany (15 May 1974).

A mobile measuring system has been developed for the function diagnostics of human organs. The specific properties of the apparatus are illustrated by the example of the measurement of the regional cerebral blood supply by means of radioactive ^{133}Xe. The course of the diffusion with time of the injected radioactive indicator is measured with a series of scintillation measuring probes distributed over various regions of the brain. A digital computer, compactly bound with the measuring unit, with an 8K-core storage takes care of the storing and calculating process of the single time-activity curves. In order to convert the measured curves into cerebral blood supply values, use is made of a compartment model which represents two kinds of different blood supplied cerebral tissue, the grey and the white cerebral substance. The eluation of the radioactive indicator from the tissue of a compartment follows a time decreasing e-function. When measuring together two different compartments, the overlapping, namely the sum of the single functions, is measured whose parameters are determined by calculation. The agreement between the measured elution curves and the model presentation is good. A typewriter installed as peripheral equipment prints the blood supply values in the form of clear tables. (GE)

11316 (BARC-711) LOW GEOMETRY ALPHA COUNTER. Samuel, J. K.; Vaidyanathan, S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 17p. Dep. NTIS (US Sales Only) $4.00.

A low geometry counter which can be used for the determination of absolute disintegration rates of α-emitting sources up to 10^9 d.p.m. is described. A collimated beam of α-particles with an accurately defined solid angle, is counted by a surface barrier type of solid state detector. The geometry factor has been computed from counter dimensions as 1132 with probable error estimated to be 0.1%. (auth)

11317 (BARC-717) ACTIVITIES IN THE FIELD OF CALIBRATION AND INTERCOMPARISONS OF RADIATION INSTRUMENTS AT TROMBAY. Gupta, U. C.; Shahani, M. G.; Misra, S. C.; Rao, P. S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 33p. Dep. NTIS (US Sales Only) $4.75.

Various sources and special installations used in calibration of gamma as well as neutron measuring instruments and monitors are described. The problems encountered in calibration are discussed. The accuracy of primary standards of sources and fluxes and results of international comparisons are given. (auth)

11318 (CONF-741112-1) OPERATION OF THE FERMILAB 200-MeV PROTON LINAC. Curtis, C. D.; Owen, C. W. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). [nd]. 25p. Dep. NTIS $4.25.

From 4th all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The linac has operated for nearly four years. Its reliability has averaged approximately 95% for the scheduled time of operation. Beam currents requested and delivered during the last two years typically have been in the 70 to 100 mA range. The emittance is approximately 3.0 cm-mrad for 90% of the 100-mA beam and the momentum spread is approximately 2.0×10^{-3} at the exit of the linac for 95% of the beam. A debuncher was installed this past summer to reduce the momentum spread at the input to the booster where the spread is otherwise increased to about 3×10^{-3} by space charge forces. (auth)

11319 (CONF-741207-1) NEUTRON SPECTRUM ANALYSIS FROM DOSIMETRY EXPERIMENTS. Kam, F. B. K.; Stallmann, F. W. (Oak Ridge National Lab., Tenn. (USA)). 1974. 37p. Dep. NTIS $5.00.

From American Society for testing materials mini-symposium on neutron asymmetry and spectrum analysis for materials applications; San Diego, California, USA (2 Dec 1974).

A fairly good approximation to a neutron spectrum can be obtained commensurable with the accuracy of the activity and cross section measurements. However, these approximations are valid only in regions where the coverage is determined by the cross sections and spectrum used, and may be locally disturbed by poor resolution. Coverage and resolution are two properties which determine the goodness of a given monitor set. The trial spectrum influences the outcome of the unfolding only to the extent that the monitor set fails to provide the necessary coverage and resolution. (21 figures, 2 tables) (auth)

11320 (IAE-2336) INVESTIGATING PROBABILITY OF PRODUCTION OF GAMMA-RADIATION SEMICONDUCTOR DETECTORS BASED ON DIFFUSIVE p-n JUNCTIONS IN CADMIUM TELLURIDE. Bodionov, Yu. F.; Kalugina, L. I.; Mautsin, G. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 28p. (In Russian). INIS.

The characteristics of p-n transistors of cadmium telluride, obtained by thermodiffusion of In in materials of p-type semiconductors, were studied. It was shown that transistors with reverse current $I_{rev} < 10^{-7}$ amp can be used for registering the γ spectra at room temperature. The energy resolving capacity of the diffusion cadmium telluride semiconductor detectors with a volume-sensitive region of 1 to 2 mm^3 reaches $\Delta E = 5$ to 14 keV for $E_\gamma = 60$ keV in the temperature interval from -160 to 50°C. (tr-auth)

11321 (IAEA-R-720-F) USE OF SOLID-STATE DETECTORS FOR DETECTING ALPHA-PARTICLE TRACKS AND THE APPLICATION OF SUCH DETECTORS TO THE MEASUREMENT OF AIRBORNE CONTAMINATION. Final Report for the Period 15 December 1968-30 Jun 1972. Blanc, D. (International Atomic Energy Agency, Vienna (Austria)). Oct 1972. 67p. (In French). INIS.

Methods for detection of alpha-particles using solid particle track detectors, in particular those employing nitro-cellulose detectors, are discussed. The effects of the environment on the detectors and their efficiency such as the effect of humidity, oxygen, ultraviolet radiation, ozone, and temperature are discussed. Applications of these detectors for the study of radon and its daughter products in the atmosphere are considered. (INIS)

11322 (ICP-1056, pp23-24) HEALTH PHYSICS INSTRUMENT CALIBRATION SOURCE PREPARATION AND CALIBRATION. Olehy, D. A.; Wilcox, C. M. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

Calibration sources were prepared for the Health Physics Section. These consisted of two ^{240}Pu alpha sources and four ^{137}Cs beta-gamma sources each mounted on Lucite discs. These sources are used to calibrate constant air monitors, beta proportional counters, and various other monitoring instruments. (WHK)

11323 (ICP-1056, pp 35-39) GROSS BETA PROPORTIONAL COUNTING SYSTEMS. Wilcox, C. M.; Hill, A. C. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

A series of studies were conducted to improve the precision of gross beta counting of two proportional counting systems. First, an attempt was made to enlarge the proportional counting tube end-window opening to increase effective detection area. This failed to achieve the desired results. Second, the effective sample area of the 25.4-mm diam cover glass counting planchet was reduced. This resulted in improved counting precision. After this change, the two beta counting systems were recalibrated with a NBS ^{137}Cs source and an Amersham Searle Corporation ^{204}Tl standard source. The Beckman low beta counting system also was recalibrated with the same sources. (auth)

11324 (INIS-mf-1514) PROPOSED INSTRUMENTATION FOR RADIOACTIVE TRACER EXPERIMENTS IN INDUSTRY. Starkey, J. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). Nov 1973. 10p. INIS.

The proposed apparatus can be divided into two parts: (a) measuring point units, and (b) central data-receiving station. Four measuring point units will be provided, each containing a scintillation monitor, with an appropriate probe and suitable pulse-forming electronics. Each station will also have a radio transmitter enabling the detected nuclear pulses to be relayed to the central station up to 1 km away. The central station will be housed within a suitable vehicle, and will contain four independent receivers to record the pulses from each outstation. Four rate-meters, driven by the receivers, will display the incoming pulse rate for each channel. A digital recording device will take a permanent record of the incoming signals over a preselected time interval, and the record thus obtained will be retrievable on various recording devices. (INIS)

11325 (INIS-mf-1555) MEASUREMENT METHODS FOR RANGE AND STOPPING POWER OF HEAVY IONS. Alves, K. M. B. (Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Instituto de Fisica). Dec 1973. 81p. (In Portuguese). INIS.

Thesis.

A simple technique for the measurement of ranges, angular distributions and stopping power for heavy ions in solid targets is presented. The method is based on the observation of ions that recoil in the same target where they are produced by collisions between an accelerator beam and the atoms of the target. The ions must be detected in coincidence with the scattering particles, and their directions are correlated by the kinematics of the collision. The method is analyzed with simulated experiments in computer programs and preliminarily tested with targets of Mylar, exposed to a beam of protons of 2.5 MeV, from the Van de Graaff accelerator. In detection of the ions, silicon surface barriers detectors and conventional electronics are used. The principal advantages of this method are that the heavy ions are accelerated in the target itself, eliminating the need for a primary beam of that specific ion from the accelerator, and that it makes possible the use of thin targets with backing. (INIS)

11326 (JINR-13-7250) PULSE COUNTING INTEGRATED CIRCUIT CHANNEL FOR PROPORTIONAL COUNTERS. Basiladze, S. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 14p. (In Russian). INIS.

A pulse counting channel for proportional chambers constructed of intergrated circuits with emitter coupling is described. It is designed for the amplification, forming, delay, and storage of signals and for the triggering of the electronics. The minimum triggering threshold is 0.4 mV and the time resolution is 10 nsec. (tr-auth)

11327 (JINR-13-7341) SILICON SURFACE BARRIER DETECTORS WITH LOW LEAKAGE CURRENTS. Gumnerova, L.; Osipenko, B. P.; Prakhov, N. M.; Permyakova, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 10p. (In Russian). INIS.

A technology is proposed for the fabrication of Si surface-barrier detectors from high-Ohm n-Si, guaranteeing almost 100% efficiency of the device with high energy resolution, low reverse currents of the order of 1 μamp at 1000 V, and working voltage of 250 and 600 V at temperatures of 20 and −100°C respectively. (tr-auth)

11328 (Y-DD-113) EXPERIMENTS TO DETERMINE SENSITIVITY OF NMC GAMMA MONITORS TO DISTANT FISSION BURSTS. Crume, E. C. (Oak Ridge Y-12 Plant, Tenn. (USA)). 12 Dec 1974. Contract W-7405-eng-26. 7p. Dep. NTIS $4.00.

In February and March 1967, experiments were run both at the Oak Ridge National Laboratory and the Oak Ridge Critical Experiments Facility (ORCEF) at the Oak Ridge Y-12 Plant. In these experiments, from one to four calibrated Nuclear Measurements Corporation (NMC) gamma detectors with built-in trip points were located from 1000 to 1100 feet from prompt burst reactors. The NMCs were calibrated in the calibration facility at Y-12. They were operated from either gasoline generators or truck-mounted 110-volt generators for both the tests and calibrations. Because the NMCs used did not have latching-trip relays, a latching-trip box containing four such relays was built and used in these tests. Bursts having fission yields ranging from 7.13×10^{14} to 1.3×10^{17} were observed in these experiments. The full width at half maximum of the bursts ranged from a few hundred microseconds to approximately 3 milliseconds. Results of the experiments are given. (auth)

11329 RECENT DEVELOPMENTS IN PHOTOMULTIPLIERS FOR LIQUID SCINTILLATION COUNTING. Persyk, D. E.; Lewis, T. T. (RCA Corp., Lancaster, PA). pp 21-27 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

Materials used in photomultiplier construction have been investigated for radioactive and fluorescent properties. The newer photomultiplier for liquid scintillation counting, the 4501V4, is contrasted with the type 4501V3 in terms of E^2/B in the tritium and carbon windows, crosstalk, background and accidental count rates. A discussion of the effect of tube materials on photomultiplier performance is given. Future trends in photomultipliers are also discussed. (UK)

11330 INTERCOMPARISON OF COMMONLY USED LIQUID SCINTILLATION COUNTING VIALS. Painter, K.; Gezing, M. J. (Amersham/Searle Corp., Arlington Heights, IL). pp 34-40 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A comparison of common counting vials has shown that the optimum counting vial for a particular experiment depends upon volume of sample, counting efficiency or quench and background count rate. Eight commonly used vials including three miniature vials are intercompared with respect to two figures of merit. Users are warned regarding the re-use of scintillation vials and the application of the external standard ratio method of quench correction to vials of different construction. The sample channels ratio technique of quench correction is shown to be independent of vial material or shape. (UK)

11331 COLOUR QUENCHING IN LIQUID SCINTILLATION COINCIDENCE COUNTERS. ten Haaf, F. E. L. (Philips Gloeilampenfabrieken NV, Eindhoven, Netherlands). pp 41-43 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

Further comments are made on a quenching model previously described (ten Haaf, F. E. L. Liquid Scintillation Counting, Heyden, London, Vol 2, p 39 (1972)). From the original model it was concluded that chemically quenched samples and optically quenched samples must produce differently shaped pulse height spectra in coincidence counters provided with linear summation. However, it is here suggested that logarithmic summation is applied so that the geometric mean of the individual photomultiplier pulses is obtained as opposed to the arithmetic mean that is obtained by linear summation. According to this model the geometric mean of the individual photomultiplier pulses is proportional to E and independent of the position of the scintillation even in the sample. (UK)

11332 FUNDAMENTAL APPROACHES FOR THE ASSESSMENT OF CHEMICAL AND COLOUR QUENCHING IN BACKGROUNDS AND SAMPLES. Stanley, P. E. (Adelaide Univ., Glen Asmond, Australia). pp 65-75 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

Attention of workers in the liquid scintillation counting field is drawn to the considerable errors which can arise in calculation of the disintegration rate due to chemical and color quenching. In particular the change in the background counting rate which is present with various degrees of quenching and the very different shapes of pulse height spectra observed for color and chemically quenched samples and the consequent problem of the assessment of quenching using the pulse height shift procedure are discussed. (UK)

11333 NEW METHOD FOR OBTAINING THE QUENCH CORRECTION CURVE IN LIQUID SCINTILLATION COUNTING. Reunanen, M. A. (Univ. of Turku, Finland); Soini, E. J. pp 86-93 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A method for quench correction in liquid scintillation counting is described. The active internal standard, in dry form, is added in a glass capsule. The quenching agent is added by means of a special evaporating device while the counter is repeatedly tabulating the counting results of c.p.m. and channels ratio. The reproducibility of the standard capsules has shown a standard deviation of 0.2%. The absolute accuracy depends mainly on the accuracy of the reference materials used. The evaporation device is suitable when using low viscosity scintillation mixtures. (UK)

11334 FLEXIBLE FORTRAN IV PROGRAM FOR SCINTILLATION COUNTER DATA PROCESSING WITH OPTIONAL FEATURES

FOR USER'S SPECIFIC REQUIREMENTS. Bowyer, D. E.; Pearson, J. D. (Cambridge Univ., Eng.). pp 94-106 of Liquid Scintillation Counting. Vol. 3. Crook, M. A. (ed.). London; Heyden (1974).

From conference on liquid scintillation counting; Brighton, Eng. (3 Sep 1973).

A program is described written in FORTRAN IV which provides very general facilities for processing scintillation counter data according to simple self-explanatory instructions supplied by the user. The facilities of the program and the format of instructions are given. Quench correction can be either by the External standard Channel Ratio (ECR) or by the Sample Channels Ratio (SCR) methods. Errors arising from counting statistics and in interpolating quench correction curves are discussed. (UK)

11335 TECHNIQUES IN NUCLEAR STRUCTURE PHYSICS. Parts I and II. England, J. B. A. London; MacMillan (1974). 697p.

The subject is dealt with in chapters entitled: detectors and methods of detection; general instrumentation; accelerators; magnetic spectrometers and spectrographs; particle identification techniques; coincidence measurements, angular correlation and lifetime measurements; polarized beams and polarized targets. It is stated that the text is essentially for final-year undergraduates and first- and second-year postgraduates. The reader has been directed to existing texts where good review articles have been published. Each chapter contains an extensive bibliography. (UK)

11336 FORMATION OF FAST HEAVY ION TRACKS IN NUCLEAR EMULSIONS. Jensen, M.; Larsson, L.; Mathiesen, O.; Rosander, R. (Lund Univ., Sweden). Radioprotection; 9: No. 1, 7-14(1974). (In French).

A detailed study of the tracks of fast, heavy ions in an ILFORD G5 type electron-sensitive nuclear emulsion was carried out. Using a nuclear track photometer with a narrow slit, the transverse absorption profiles of 27 tracks of nuclei with charge numbers 14, 16, 20, 24 and 26, in the velocity range 0.3 to 0.8 c were registered. The charges of the heavy nuclei, emanating from the cosmic radiation, had previously been determined using photometric methods. Theoretical track profiles were computed from the distribution of energy density around the path of a passing ion. This dose distribution was evaluated according to the delta-ray theory of track structure developed by Katz, et al. The calculated profiles were fitted to the experimental data using a parameter optimization algorithm. From this comparison it is concluded that a reasonable agreement between experimental and calculated profiles can be obtained if the light backscattered in the emulsion is adequately compensated. (FR)

11337 NEUTRON DETECTOR DEVICE. Allemand, R.; Jacobe, J. (to Commissariat a l'Energie Atomique). French Patent 2,176,496. 21 Mar 1972. 10p. (In French).

The invention relates to a device for localizing a neutron beam comprising a thin deposit of a solid substance which generates ionizing particles. This device is characterized in that: (a) the electrodes of a given polarity are constituted by thin deposits of a solid substance adapted to generate ionizing particles under the action of a neutron beam, said electrodes forming parallel strips evenly spaced on the enclosure wall hit by the radiations, and (b) the electrodes of the opposite polarity are applied against the opposite wall of said enclosure and form evenly spaced parallel strips at right angles to the cathodes. The enclosure is filled with a gas. This device can be used for studying organic structures through neutron diffraction. (FR)

11338 DOSE REQUIREMENTS IN DIRECT AND INDIRECT RADIOGRAPHY WITH HIGH-RESOLUTION X-RAY IMAGE-INTENSIFIER TUBES. Schuster, W. (Erlangen-Nuernberg Univ., Ger.); Heinrich, H. Ann. Radiol.; No. 4, 427-433(May 1974). (In French and English).

The present paper confirmed that by using the indirect technique in conjunction with the high-resolution image intensifier the dose per frame could be reduced by a factor of 10 compared with direct radiography, without degrading the image quality. It was also shown that in GI and urological examinations a further reduction of the dose per frame is possible without impairing the diagnosis, although the image quality is poorer. In micturition cystourethrography, which involves a particularly high gonadal burden, an even greater reduction of the dose per frame appears to be possible. (FR)

11339 COMPARISON OF SECONDARY ELECTRON EMISSION DUE TO POSITRON, ELECTRON, AND POSITIVE ION BOMBARDMENT. Pendyala, S.; McGowan, J. W. (Univ. of Western Ontario, London). Can. J. Phys.; 52: No. 22, 2215-2219(15 Nov 1974).

The relative secondary electron yield under positron, electron, and positive ion (alkali ions: Na^+ or K^+) bombardment is determined for the cone of a spiraltron detector (Bendix Model 4219X). The method is based on the proportionality of yield to the mean of the pulse height distribution for the bombarding particle of a given energy. The ratio of the yields under electron and positron bombardments is found to be 1.2 to 1.0 for the semiconducting lead glass of the cone of the spiraltron through the energy range of 0.1 to 1.0 keV. Cherry found this ratio to be 3.0 ± 0.3 at 0.94 keV. The positive ion yield is ≈1.5 (absolute) throughout this energy range. (auth)

11340 WHOLE BODY COUNTER TRUCK (7 FEB 1967) (ENGINEERING MATERIALS). (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). (CAPE-2393).

5 drawings.

The whole body counter truck is a mobile unit on a semitrailer used as a measuring device to detect the amount and location of any gamma radiation over 100 keV emanating from the body of a person being drawn on a pallet below a 4" × 11" NaI crystal, the detector. Use has been chiefly for Hanford reactor personnel, although a second unit contained in the truck has been used in research with various populaces. (auth)

11341 APPLICATIONS OF LIQUID SCINTILLATION COUNTING. Horrocks, D. L. New York; Academic Press, Inc. (1974). 357p.

Discussions of the theory of liquid scintillation counting processes, the choice of the components of the liquid scintillator solution, and the development of the liquid scintillation counter and the multiplier phototubes are presented. These discussions are followed by considerations of the detection and measurement by liquid scintillation techniques of different types of particles produced by radionuclides. The techniques and problems of sample preparations (homogeneous and heterogeneous) are presented along with a special section on oxidation techniques. The importance and difference of several types of counting vials are detailed, and typical sources of background and problems of reducing the background are discussed. The sources of quenching in counting samples and methods of monitoring and correction for variable quench within samples are considered in detail. Several special applications of liquid scintillation techniques are presented: dual-labeled counting, chemiluminescence and bioluminescence, radioimmunoassay, Cherenkov counting, pulse shape discrimination, flow cell counting, and large-volume counters. In conclusion, the statistical considerations involved in determining the reliability and accuracy of data obtained by nuclear counting techniques are considered. (Extensive references) (WHK)

11342 A SIMPLE METHOD FOR THE MEASURING OF ENERGY IN MEDICALLY USED ELECTRON ACCELERATORS. Liesem, H.; Pohlit, W.; Heller, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Frankfurt am Main (F.R. Germany). Abt. fuer Biophysikalische Strahlenforschung). Strahlentherapie; 148: No. 1, 80-86(Jul 1974). (In German).

4 figs.; 2 tabs.; 12 refs.

The ICRU recommends various methods for the calibration of the energy scale of medically used electron accelerators. A simple method, rarely used until now, is based on the Cherenkov-effect in gases. This measuring method is described and discussed with regard to its practical application. (auth)

11343 MEASUREMENT OF THE THICKNESS OF A GOLD CONTACT ON SILICON NUCLEAR-RADIATION DETECTORS. Gatsenko, L. S.; Golovner, T. M.; Zakharchuk, O. V. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 889-891(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 224-225(1974).

A method is proposed for measuring the thickness of the gold film in the input window of silicon nuclear-radiation detectors. The method is based on the fact that the collection coefficient of gold–silicon detectors at a light wavelength of 0.75 μ is equal to unity. Determination of the thickness of the gold film is carried out by measuring the spectral sensitivity of the detector at a light wavelength equal to 0.75 μ. (auth)

11344 POSITION SENSITIVE RADIATION DETECTOR. Stumpel, J. W. M. H.; Sanford, P. W.; Rapley, C. G. (to National Research Development Corp.). US Patent 3,843,886. 22 Oct 1974. Priority date 18 May 1972, United Kingdom of Great Britain and Northern Ireland. 4p.

A position sensitive proportional converter for soft x-rays is described comprising a circular resistive sheet having four symmetrically disposed electrodes. When an event produces a charge on the surface of the sheet, the signals generated at the electrodes by the charge are analyzed so that the position and/or quantity of the charge can be calculated. (Official Gazette)

11345 ABSOLUTE DETERMINATION OF THE FAST NEUTRON FLUXES WITH A LABORATORY-FABRICATED

PROTON RECOIL TELESCOPE IN THE ENERGY RANGE FROM 0.5 TO 8 MeV. Wu, M. W.; Chou, J. C. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Nucl. Sci. J. (Taiwan); 11: No. 3, 127-136(Sep 1974).

A proton recoil telescope with solid radiators and a silicon surface-barrier detector was constructed for the absolute determination of monoenergetic neutron flux in the energy range from 0.5 to 8 MeV. For the calculation of the efficiency of the detector, a numerical integration as well as a Monte Carlo method was worked out. Additionally, a Monte Carlo program was also used to fit the experimental spectra. In these calculations, both the angular distribution and the energy spread of the emitted neutrons were considered. The total error of the measurement was estimated to be about 3%. (auth)

11346 HEAVY-ION ACCELERATOR-ELECTRON MICROSCOPE LINK FOR THE DIRECT OBSERVATIONS OF ION IRRADIATION EFFECTS. Whitmell, D. S.; Kennedy, W. A. D.; Mazey, D. J.; Nelson, R. S. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Radiat. Eff.; 22: No. 3, 163-168(1974).

A JEM 200 A electron microscope was linked to a 120 kV heavy-ion accelerator in order to observe the dynamic effects of heavy-ion bombardment of materials. The ions, produced in a sputtering ion source, are accelerated, analyzed, directed through a flight line and then deflected to strike the specimen in the electron microscope. The effects of the ion bombardment on the specimen are recorded on videotape as they occur. Details of the system and examples of its use are presented. (auth)

11347 BLOKI DETEKTIROVANIYA IONIZIRUYUSHCHIKH IZLUCHENIJ. Ehkspluatatsiya i Remont Apparatury Dlya Izmereniya Ioniziruyushchikh. (Detection Units for Ionizing Radiation. Operation and Repair of Ionizing Radiation Detectors). Makarov, V. I. Moscow; Atomizdat (1972). 72p. (In Russian).

Data on the characteristics of the principal forms of radiation and its interaction with matter and on detectors, photomultipliers, and radiation detection units are reported. The operational conditions and principles for different types of the constructive use of these units are discussed. Typical circuits for the detection units, the use and operational principles, the basic parameters, and the effect of the wiring diagrams on the characteristics of the detection units are described. The adjustment and maintenance of the units and of each individual functional component are discussed. (tr-auth)

11348 GAS DENSITY STABILIZER FOR A PROPORTIONAL COUNTER. Okawa, T. (to Rigaku Denki Co. Ltd.). Japanese Patent 1973-5750/B/. 17 Jun 1968. 3p. (In Japanese).

In order to stabilize the output pulse amplitude from a proportional counter, the density of ionization gas must be kept constant. To this end, this invention provides a device which may substantially keep the temperature constant in the proximity of a central wire and at the same time the pressure of the ionization gas as well. (WHK)

11349 WAVE-FORM DISCRIMINATING CIRCUIT FOR RADIATION-INDUCED PULSES. Kinbara, S.; Kumahara, T. (to Japanese Atomic Energy Research Inst.). Japanese Patent 1973-10433/B/. 23 Apr 1968. 5p. (In Japanese).

A wave-form discriminating circuit for the measurement of pulses is described which finds a variety of applications in scintillation counters, proportional counters, semiconductor detectors, or the like. Input pulses are at first introduced into first and second characteristic circuits, which have linear, differential and/or extending characteristics so as to produce two output pulses having their amplitudes respectively suitably voltage-divided. The input pulses are simultaneously introduced into another circuit which has a linear, integrating or differential circuit, then into a delay circuit and into a third characteristic circuit. The latter input pulses are then introduced into a polarity-reversing circuit, in which the polarity of the input pulses are reversed. The former and latter input pulses thus processed are then introduced into two voltage-dividing circuits which are composed of two resistors having an intermediate tap. The respective pulses which are extracted at the intermediate taps are then amplitude-discriminated from a reference level in a steady state. The detection is then made at such intermediate points of the pulses as cross the reference level. The time differential between the two detecting points is then detected to discriminate the wave-forms of the input pulses. (JA)

11350 CHANNEL ELECTRON MULTIPLIER AS A PARTICLE COUNTER. Barat, C.; Loubet, D. (Univ., Toulouse). pp 279-289 of Fourth Conference on Space Optics. Paris; Centre National d'Etudes Spatiales ([nd]). (In French).

From 4th conference on space optics; Marseille, France (6 Nov 1973).

The best conditions for the use of the channel electron multiplier (C.E.M.) as a particle counter are examined. The problem is studied by analyzing the secondary electron multiplication process and treating the output pulses. The conclusions are illustrated by a review of electronic systems associated with the C.E.M. (FR)

11351 SEMICONDUCTOR ELECTRON SPECTROMETER FOR SPACE STUDY. Alekseev, N. V.; Vakulov, P. V.; Kovrygina, L. M.; Mineev, Yu. V.; Shcherbovskii, B. Ya. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 273-276(1974).

Translated from Kosm. Issled.; 12: No. 2, 301-304(1974).

A spectrometer is described based on the use of a telescope and using silicon drift detectors, which permits registration of electrons over the energy range 0.3 to 2 MeV in the presence of a proton noise current up to 10^7 particles/cm^2 · sec · sr. (WDM)

11352 GAMMA RAY IMAGING SYSTEM. Macovski, A. US Patent 3,840,747. 8 Oct 1974. Filed Date 9 Apr 1973. 10p.

A multi-aperture plate is placed between a radioactive source and a gamma ray camera. This creates a sum of images, each seen through a different aperture position. Each aperture image is cyclically modulated with a moving shutter. On reconstruction the individual images are demodulated by using their carrier signals. The individual images are translated and combined to view any section of the radioactive source. (Official Gazette)

11353 VARIOUS ASPECTS OF THE ATTENUATION COEFFICIENT OF A NEUTRON MONITOR. Raubenheimer, B.C.; Stoker, P.H. (CSIR Cosmic Ray Research Unit, Potchefstroom University for CHE, Potchefstroom, South Africa). J. Geophys. Res. 79: No. 34, 5069-5076 (1 Dec 1974).

By means of data obtained during 1969 and 1971 with an airborne neutron monitor the pressure, cutoff rigidity, and solar modulation dependence of the attenuation coefficient of the neutron monitor were investigated. Special attention was given to the experimental and statistical errors introduced by the measurements and analyses. The pressure, cutoff rigidity, and solar modulation dependence of the attenuation coefficient are discussed and compared with other results, and finally incorporated into a single empirical equation. It is shown that the effect of stopping muons on the attenuation coefficient of the neutron monitor may be neglected in transforming to a vertical attenuation coefficient. It is also confirmed that the specific or partial attenuation coefficient is independent of the solar activity and is in good correspondence with results obtained from Monte Carlo calculations. (auth)

11354 RADIATION LIMITS OF SEALED, GAS-DISCHARGE PROPORTIONAL X-RAY COUNTERS. Goganov, D. A.; Kruglov, M. V.; Shchemelev, V. I. App. Metody Rentgenovskogo Anal.; No. 13, 229-234(1974). (In Russian).

A method is described of measuring the radiation endurance of gas-discharge proportional x ray counters. It was established that the radiation endurance of a commercial, xenon-methane proportional counter SRPO-16 on irradiation with monochromatic x rays in the wavelength region of 1.5 to 3.0 Å at a counter voltage of 1000 V is equal to 3 to 5×10^{16} pulses. (SJR)

11355 TEMPERATURE DEPENDENCE OF SENSITIVITY OF SILICON SURFACE-BARRIER DETECTORS OF ROENTGEN AND RADIATION. Petushkov, A. A.; Parker, R. P. Med. Radiol.; 19: No. 11, 59-64(Nov 1974). (In Russian).

The temperature dependence of the sensitivity of Si surface-barrier detectors was studied in order to establish the principles of the dependence and to reduce it. The effect of temperature on the minimum dose rate which can be reliably measured was also studied. The experimental results showed that after subtraction of the background the signal of the measured current I_L depends on the temperature in agreement with theoretical predictions. The signal is reduced with increasing temperature if R_i is comparable to R_L (transition resistance and load resistance, respectively) and is independent of temperature within experimental error if $R_L \approx 0$. (JSR)

11356 APPARATUS FOR MEASURING NEUTRON FLUX. Fujii, M. (to Hitachi Ltd.). US Patent 3,845,311. 29 Oct 1974. Priority date 4 Dec 1970, Japan. 8p.

An apparatus for measuring neutron flux in a nuclear reactor is described. The neutron flux distribution within the reactor core is represented by a predetermined function, and the velocity of a neutron detecting fluid circulating through the reactor core is varied and/or various neutron detecting fluids having different decay constants are circulated through the reactor core to measure the radioactivity induced in the fluid or fluids thereby seeking the above function for determining the power distribution within the reactor core. (Official Gazette)

11357 PROCESS FOR MAKING LIGHT CONDUCTING PLATES. Ortner, L.; Heinzelmann, K. G.; Conrad, B.; Dierker, J. (to Siemens Aktiengesellschaft). US Patent 3,847,696. 12 Nov 1974. Priority date 27 Aug 1970, F.R. Germany. 6p.

A process for producing light-conducting plates which are particularly capable of use at the inlet of gamma cameras is characterized by the use of transparent rods which are placed one next to the other, while means constituting distance holders which are thicker than the length of the light wave to be transmitted are placed between the rods. At least one end of the rods is fixed by a casing mass, then it is ground and polished, and then the casting mass as well as the grinding and polishing means are removed. (Official Gazette)

11358 SYSTEM FOR WHOLE BODY IMAGING AND COUNT PROFILING WITH A SCINTILLATION CAMERA. Cooke, M. B. D.; Kaplan, E. US Patent 3,839,641. 1 Oct 1974. Filed Date 22 Jun 1973. 16p.

The present invention relates to a method of and apparatus for the radionuclide imaging of the whole body of a patient using an unmodified scintillation camera which permits a patient to be continuously moved under or over the stationary camera face along one axis at a time, parallel passes being made to increase the dimension of the other axis. The system includes a unique electrical circuit which makes it possible to digitally generate new matrix coordinates by summing the coordinates of a first fixed reference frame and the coordinates of a second moving reference frame. (Official Gazette)

11359 SCINTILLATION CAMERA WITH IMPROVED LINEARITY. Van Dijk, N.; Kulberg, G. H. (to G. D. Searle and Co.). US Patent 3,851,177. 26 Nov 1974. Filed Date 23 Feb 1973. 10p.

An Anger-type scintillation camera having analog circuitry in the form of seven correction generators each associated with one of a central seven of an array of nineteen photomultiplier tubes to compensate for spatial non-linearities in the camera is described. Each correction generator is active for scintillations produced by gamma ray interactions near its associated photomultiplier tube and produces correction signals which are added to the coordinate signals of an Anger-type camera to produce corrected coordinate signals which represent more accurately the true spatial coordinates of the gamma ray interaction. (Official Gazette)

11360 TRANSMISSION ION CHAMBER. McIntyre, R. D. (to Varian Associated). US Patent 3,852,610. 3 Dec 1974. Filed Date 26 Feb 1973. 8p.

A linear particle accelerator having detection apparatus for detecting the presence of and correcting for beam misalignment is described. The linear accelerator includes a charged particle accelerator system and deflection coils for changing both the positional and angular displacement of a charged particle beam. A target is disposed in the particle beam path for emitting X-rays upon being struck by the charged particles. The photon field developed by the target takes the form of a forward-peaked lobe configuration extending from the target. An ionization chamber is disposed in the radiation field for developing electrical signals responsive to changes in the lobe field. The ionization chamber includes a housing member, and an insulative sheet such as a sheet of thin glass or mica is supported within the housing member. A pattern of detection electrodes is formed on the insulative sheet by vacuum deposition or other similar process. A high voltage electrode comprising a sheet of conductive material is supported within the housing member in spaced parallel relationship with the detection electrodes. (Official Gazette)

11361 SCINTILLATION CAMERA WITH RAPID SEQUENCE IMAGING DEVICE. Gramm, R. F.; Walton, P. W. (to Nuclear-Chicago Corp.). US Patent 3,852,602. 3 Dec 1974. Filed Date 4 Dec 1972. 10p.

An Anger-type camera with a rapid sequence imaging device for recording a series of sequential images on a single sheet of 11 × 14 inch photographic film is described. The CRT image is minified and electronically stepped across the CRT screen under the control of a timer. The minified image can also be placed at a particular selected location by a manual control. (Official Gazette)

11362 SCANNING DEVICE FOR SCINTIGRAPHY ACCORDING TO THREE ORTHOGONAL PLANES. Casale, R. (to Ital Elettionica S.p.A.). US Patent 3,852,601. 3 Dec 1974. Priority Date 15 Jul 1971, Italy. 10p.

A device for the scintigraphic scanning according to three orthogonal planes is described comprising a carrier structure for the detecting heads including (a) one horizontally located beam, longitudinally oriented; (b) two vertical columns the bases of which are provided with rolling means suitable to cause them to longitudinally slide along the beam, remaining guided thereon; (c) two carriages provided with rolling means capable of causing the carriages to slide vertically each on one column, remaining guided thereon, and provided further with a recess with rolling means capable of supporting and causing to horizontally and transversely slide a support rod for the detector; (d) two supporting rods each supporting a detector—each sliding in a vertical recess in one of the carriages; (e) a bracket for a first detecting head connecting it to the end of the associated supporting rod and provided with pre-setting means with orthogonal axes for the rotation about the center of gravity of the head toward all desired directions and oriented for descending in oblique directions so that the head will remain below the rod and displaced toward the second column; and (f) a bracket for the second detecting head connecting it to the end of the associated support rod being provided with a knuckle for presetting a rotative position about an axis parallel to that of the rod and for its horizontal along it so that the head will become displaced toward the first column with respect to the rod, and will be thus capable of aligning with the other head in both vertical and horizontal directions. (Official Gazette)

11363 SCINTILLATION CAMERA WITH IMPROVED RESOLUTION. Larsson, A. US Patent 3,852,598. 3 Dec 1974. Priority date 23 Nov 1971, Sweden. 8p.

A scintillation camera with a multichannel collimator and an optical or electronic demodulator operating on the spatial coordinate output of the camera to produce a mirror image reversal of outputs associated with radiation quanta traversing individual channels of said collimator is described. The mirror image reversal is produced with respect to a central axis of each collimator channel. (Official Gazette)

11364 EFFECT OF SCATTERED RADIATION ON SCINTILLATION CAMERA COLLIMATOR OPTIMIZATION. Dubuque, G. L. Cincinnati; Univ. of Cincinnati (1974). 142p. University Microfilms Order No. 74-28,848.

Thesis (Ph. D.).

A random-walk (Monte Carlo) method has been used to determine the photon distribution emerging from a line source embedded in tissue-equivalent media. This information concerning the photon distribution is then used as input for a computer program which calculates a line spread function using collimator dimensions and the pulse height analyzer settings as the independent variables. The calculation of the line spread function is similar to a technique developed by Simmons. Through a combination of resolution, determined by the line spread function, and the calculated sensitivity an overall rating, or objective function, is calculated for each collimator. The independent variables are then manipulated by a sequential pattern search computer program in an effort to obtain the collimator with the best objective function, i.e., the optimum collimator. The results show that the collimator dimensions are not significantly affected by the amount of scatter as used in a clinical situation, but that the introduction of scattered radiation significantly reduces the objective function as compared to the no-scatter condition. This is because of the poor energy resolution of the NaI crystal. Despite the energy resolution of the crystal degrading the objective function it was found that a change in energy resolution has little if any effect on the dimensions of the optimum collimator. The dimensions of the optimum collimator are, however, strongly related to the spatial resolution characteristics of the camera crystal. For the two systems investigated a clinical window width setting of 30% was shown to be optimum for imaging objects in the range of 0.5 to 2.0 centimeter diameter. (Diss. Abstr. Int., B)

Radiation Dosimeters

Refer also to abstracts 10705 and 11485–11487.

11365 (AD-784370) RESPONSE OF SELECTED GAMMA-RAY DOSIMETERS TO HIGH ENERGY (2.25 TO 9 MeV) PROTONS. Final Report. McNeilly, J. H.; Rodgers, M. P. (Ballistic Research Labs., Aberdeen Proving Ground, Md. (USA)). Aug 1974. 64p. (BRL-1734). NTIS $3.75.

The objective of this effort was to measure the response, relative to ^{60}Co radiation, of lithium fluoride (LiF), lithium borate ($Li_2B_4O_7$), and manganese activated calcium fluoride (CaF_2:Mn) thermoluminescent dosimeters, and silver activated metaphosphate ($AgPO_3$) glass dosimeters to monoenergetic photons in the 2.25 to 9 MeV energy region. (GRA)

11366 (BARC-709) CHEMICAL DOSIMETRY: A REVIEW. Gupta, B. L.; Gomathy, K. R.; Bhat, R. M. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 54p. Dep. NTIS (US Sales Only) $5.75.

A brief description of the present status of chemical dosimetry is presented. Many chemical dosimetric systems have been investigated and some are routinely in use for dosimetric purposes. The Fricke dosimeter is in use as a dosimetric standard. For dosimetry in food and medical equipment sterilization operations, plastics have become very popular because of their ease of handling although they are not as accurate as the Fricke dosimeter. Many systems have been studied for dosimetry below 1000 rads but few have proved to be really effective. A dosimetric system containing ferrous sulphate, benzoic acid and xylenol orange in 0.05 N sulphuric acid (FBX dosimeter) is suitable for low dose measurements. Although many dosimetric systems have been proposed for mixed radiation fields, none has proved to be entirely satisfactory although the oxalic acid system appears promising. A number of studies have been reported on plastic containers suitable for chemical dosimetric solutions but there remains much scope for further investigations in this area. A bibliography of chemical dosimeters covering the period up to December 1961 was published earlier (AEET/RMS/7). The present review includes a bibliography in this field from 1961 onwards. The 465 references in it are divided into topics such as general, oxalic acid system, gaseous dosimeters, dye systems, halogen compounds, polymer systems, ferrous sulphate and miscellaneous. Some of the recent papers have been included at the end. An author index is also given. (auth)

11367 (CEA-R-4637) LOW CURRENT INTENSITIES MEASUREMENTS AT THE LABORATOIRE DE METROLOGIE DES RAYONNEMENTS IONISANTS: APPLICATION TO EXPOSURE DETERMINATION. Guiho, J. P.; Ostrowsky, A.; Simoen, J. P.; Hillion, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91—Gif-sur-Yvette (France). Div. de Chimie). Dec 1974. 23p. (In French). Dep. NTIS (US Sales Only) $4.25.

In the field of ionizing radiation metrology, the determination of certain quantities by means of ionometric techniques necessitates the measurement of current intensities as low as 10^{-16} A. After a theoretical and practical examination of the possible accurate measurement techniques, the choice of the "rate of drift" method is justified. The electronic device, its automation and the data analysis and treatment are described. With this device, the selected method allows measurements of ionization current intensities $\geq 10^{-14}$ A with an overall uncertainty less than or equal to some 10^{-3}. (auth)

11368 (GSF-S-305) PERSONNEL DOSE MONITORING WITH SOLID DOSIMETERS. Regulla, D. F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F.R. Germany). Inst. fuer Strahlenschutz). 1974. 11p. (In German). (AED-CONF-74-044-013). INIS.

From exhibition and experts' meeting "Nuclear Technology;" Frankfurt am Main, F. R. Germany (18 Mar 1974).

26 figs.

The solid dosimetric techniques used for personnel dosimetry, the phosphate glass and thermoluminescence dosimetry, and the importance of solid dosimetry in personnel monitoring are discussed. (auth)

11369 (IAEA-159, pp 99-113) STANDARD PROCEDURE FOR THE USE OF THE CLEAR PERSPEX HX DOSIMETER IN THE DOSE RANGE 1 TO 10 MRAD. Chadwick, K. H. (Euratom-ITAL, Wageningen, Netherlands). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The development of an operational dosimetry system for the dose monitoring in an industrial irradiator facility delivering high doses of ionizing radiation is discussed. Major discussions center around the use of clear perspex HX dosimeters operating in the dose-range of 1 to 10 Mrad. Data are presented on the effects of various environmental factors (such as light, temperature, air, storage time) during and after irradiation as well as the wavelength used for optical density measurements on the performance, reliability and reproducibility of the dosimeter system. On the basis of these findings a detailed procedure and protocol are given for the preparation of clear HX perspex as the dosimeter, the procedure for spectrophotometer readings using 314 nm and other precautionary measures and the final calibration for the most effective and reliable estimation of the absorbed dose quantities. (auth)

11370 (IAEA-R-530-F) INVESTIGATION ON THERMOLUMINESCENCE DOSIMETRY (TLD). Final Report for the Period 1 June 1968—30 September 1972. Ganguly, A. K. (International Atomic Energy Agency, Vienna (Austria)). Apr 1973. vp. INIS.

The thermoluminescence properties of CaF_2 (natural), LiF (Mg), $CaSO_4$(Tm), $CaSO_4$ (Dy), and local quartz were studied in detail. $CaSO_4$ (Tm) and $CaSO_4$ (Dy) are the most sensitive materials and are very suitable for gamma dosimetry. Pink quartz is very sensitive and its sensitivity can be enhanced by heating to temperatures above 500°C and by exposure to about 10^6R of gamma radiation. A study of the neutron sensitivity of detectors embedded in 2 mm thick polyethylene showed that $Li_2B_4O_7$ (Mn) has the highest neutron/gamma sensitivity ratio and CaF_2 the least. (WHK)

11371 (IAEA-R-896-F) DEVELOPMENT OF A METHOD OF SELECTIVE MEASUREMENT OF THERMAL NEUTRON AND GAMMA RADIATION EXPOSURES IN A MIXED RADIATION FIELD FOR NORMAL AND ACCIDENT CONDITIONS BY MEANS OF THERMOLUMINESCENT DOSIMETERS OF MULTIPLE USE. Part of a Coordinated Program on Nuclear Accident Dosimetry. Final Report for the Period 1 May 1970—31 May 1973. Mishev, I. T. (International Atomic Energy Agency, Vienna (Austria)). Jul 1973. 8p. INIS.

The suitability of thermoluminescent dosimeters based on natural fluorite (CaF_2) which is obtained on large scale in Bulgaria was investigated for the selective measurement of gamma- and thermal neutron doses in mixed gamma-neutron radiation fields. Dosimeters were prepared of homogeneous mixtures of natural fluorite and lithium fluoride (LiF) containing ^{6}Li up to 25% of the total mass of the mixture on a glass and teflon base. Dosimeter parameters were studied using the gamma ray field of a ^{60}Co source and the mixed radiation field of the thermal column of the IRT reactor at Sofia. From these investigations it was concluded that a simple and small personnel dosimeter system can be used for the quick reflective measurement of gamma and neutron doses in mixed radiation fields of gammas and thermal neutrons at an accuracy of better than 20%. The dosimeter system consists of two parts, i.e., a gamma-sensitive dosimeter of natural fluorite and a neutron-sensitive dosimeter prepared of a homogeneous mixture of natural fluorite and lithium fluoride containing about 15% ^{6}Li. By incorporating 50% teflon, gamma doses down to 50 mR and thermal neutron doses down to 50 mrem can be measured. (INIS)

11372 (IAEA-R-897-F) STUDIES ON FACTORS AFFECTING ACCURACY OF INDIVIDUAL DOSE MEASUREMENTS BY MEANS OF RADIOPHOTOLUMINESCENT (R.P.L.) AND THERMOLUMINESCENT (T.L.) DOSIMETRIC SYSTEMS. Part of a Coordinated Program on Nuclear Accident. Final Report for the Period 1 June 1970—31 May 1973. Nicolae, M. (International Atomic Energy Agency, Vienna (Austria)). Aug 1973. 60p. INIS.

The aim of the project is to study various factors affecting the results of dose measurement with photoluminescent and the thermoluminescent detectors, in order to improve the accuracy of the dosimetry with these solid integrated detectors. For the study of R.P.L. dosimetric systems, phosphate glass detectors made in Rumania as well as French and Japanese phosphate glass detectors were used. For the study of T.L. dosimetric systems TLD-100 lithium fluoride powder was used. These detector systems were exposed to gamma rays of ^{60}Co or ^{137}Cs under various conditions. The reading equipment was designed by the Institute for Atomic Physics Bucharest. The R.P.L. glass detector has a very slow fading for a long term storage and the effect of temperature below 50°C was observed to be very small. For a good quality photomultiplier tube, a well stabilized power unit, and a well controlled and stabilized uv source, the reading errors of the phosphate glass detectors can be kept within 2%. As a result of the annealing experiments at a higher temperature the R.P.L. dosimetric systems using phosphate glass may be considered more reliable than the T.L. dosimetric systems using lithium fluoride powder, if the detectors were to be used repeatedly by annealing regeneration. The sensitivity fluctuation of the T.L.D. lithium fluoride during the erasing cycle seems to be more important under the conditions of the experiment. For accurate dose measurement by this method, a recalibration of the T.L.D. powder is necessary after annealing regeneration cycle. (INIS)

11373 (ZJE-152) DESIGN OF A CALORIMETER FOR MEASURING GAMMA RADIATION IN AN EXPERIMENTAL REACTOR. Jirousek, V.; Kott, J.; Planicka, J.; Teren, S. (Skoda, Pizen (Czechoslovakia)). 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The calculation techniques and the design of calorimeters for in-core measurement of gamma dose rates within a region of 10^5 up to 10^9 rad/hour are described. Two alternatives, i.e., an axial and a radial arrangement of the calorimeter are considered. The material of calorimetric bodies are tungsten and platinum. (auth)

11374 IMPROVEMENTS IN OR RELATING TO RADIATION DETECTORS. Sharpe, J. (to EMI Ltd.). British Patent 1,363,655. 14 Aug 1974. Filed date 30 Oct 1970. 3p.

Reference is made to dosimeters of the type comprising a sealed transparent insulating tube containing a dry gas and plastic microspheres of about 1 mm diameter. The tube material is different from that of the microspheres. When the tube is vigorously shaken the microspheres become charged and adhere to its smooth inner wall. When the tube is then exposed to radiation the gas becomes ionized and neutralizes the charges on the microspheres, which then fall to the bottom of the tube. The number of microspheres that become detached depends on the amount of radiation to which the tube is subjected. Such a dosimeter, however, normally has a total capacity of only about 5 R. The main reason for this limited capacity is the weight of the microspheres. The improved dosimeter employs particles of expanded plastic material. This material should not be fireproofed, as such treatment adversely affects their properties for dosimeter use. (UK)

11375 APPARATUS FOR THE QUICK TRACING OF ISODOSES IN X-RAY TREATMENT. Pinel, J.; Bethencourt, A. (to Thomson-CSF). French Patent 2,173,731. 29 Feb 1972. 10p. (In French).

The device according to the invention is adapted to visualize the therapeutic irradiation isodose curves at a given depth in a phantom which simulates a portion of the human body. According to a preferred embodiment the apparatus comprises a shallow basin with parallel transparent accurately machined sides containing a liquid scintillator, said basin being dipped into the phantom. The photons emitted by the scintillator are collected separately by optical means on a transducer which modulates the intensity of the electron pencil of an adjustable threshold cathode-ray oscilloscope. (FR)

11376 DETERMINATION OF THE IRRADIATION FIELD OF A 6-MEV PORTABLE COMMERCIAL BETATRON. Benko, L.; Golder, F. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 484-488(1974). (In Hungarian).

The determination of the distribution of direct and scattered radiation of a PMB-6 type betatron is described. The error of personnel dosimeters is 80 to 100% in direct and 40% in the scattered beam. Thermoluminescent dosimeters may be used for routine personnel dosimetry with an error of 30%. (auth)

11377 MEASUREMENT OF X-RAY AND ELECTRON DOSE BY MEANS OF SOLID-STATE TRACK DETECTORS. Varnagy, M.; Csikai, G.; Szegedi, S. (Kossuth Lajos Tudomanyegyetem, Kiserleti Tanszek, Debrecen, Hungary). Izotoptechnika; 17: No. 9-10, 480-483(1974). (In Hungarian).

T-Cellit cellulose acetate foil is suitable for the measurement of doses higher than 1 Mrad. The accuracy of measurement is 1 Mrad for electrons and 3 Mrad for x-rays. (auth)

11378 RADIATION DOSIMETRIC PROPERTIES OF CaF_2 USING THERMALLY STIMULATED EXOELECTRON EMISSION WITH A GAS FLOW PROPORTIONAL COUNTER. McManaman, V. L. Lafayette, IN; Purdue Univ. (1972). 181p. University Microfilms Order No. 74-26,668.

Thesis (Ph. D.).

To learn more of the characteristics of TSEE dosimetry, a research program was undertaken, in which a complete TSEE dosimeter readout system was developed, and in which some basic dosimetric properties of CaF_2 were studied. A windowless gas flow proportional counter using a counting gas of 90% argon and 10% methane satisfactorily detected exoelectrons. A linear temperature programmer powered and monitored a nichrome heater in a drawer which was adapted to a commercially available counting chamber and anode wire assembly. Data were recorded with a multichannel analyzer operated in the multi-scaler mode. Two emission peaks were observed at temperatures of 79°C and 115°C for CaF_2 from one source. A lower sensitivity was observed from CaF_2 from a different source with emission peaks at temperatures of 79°C and 142°C. The sensitivity of CaF_2 dosimeters which were allowed to stand uncovered in normal room air prior to irradiation decreased in time (27% within 10 hr). However, no significant decrease in sensitivity was observed up to 136 hr when the dosimeters were covered with a lucite plate. A large number of counts was obtained from unirradiated control dosimeters which were stored in vacuum. In addition, irradiated dosimeters which were stored in vacuum prior to irradiation exhibited poor reproducibility. Preirradiation heating produced a slight increase in sensitivity at 200°C, and then a continual decline in sensitivity up to 1000°C. Emission peaks at 79°C and 115°C remained for heating temperatures up to 350°C. After a heating at 400°C, peaks occurred at 69°C and 115°C. Higher temperatures generally yielded reproducible total counts, but often exhibited quite erratic glow-curve characteristics particularly after the 69°C emission peak. After a heating at 600°C, peaks occurred at 69°C and 162°C. Emission peaks were observed at 69°C and 115°C and the main peak at 162°C after a 900°C heating. Except for a less apparent 115°C peak, the same peaks occurred after a 1000°C heating. A linear response to exposure was found for pure CaF_2 dosimeters from 25 R to 125 R and for mixed 75% CaF_2 and 25% graphite dosimeters from 40 R to 310 R. A response decrease of approximately 19% occurred within 32 hr after irradiation, and a decrease by approximately 25% occurred within 122 hr after irradiation. The decrease was primarily due to the 79°C peak. (WHK)

11379 DOSIMETRIC PROPERTIES OF LITHIUM FLUORIDE USING THERMALLY STIMULATED EMISSION OF EXOELECTRONS. McArthur, W. C. Lafayette, IN; Purdue Univ. (1972). 192p. University Microfilms Order No. 74-26,667.

Thesis (Ph. D.).

To further understand the TSEE properties of LiF, the current study consisted of determining the parameters that are necessary in order to maximize the sensitivity and reproducibility of LiF dosimeters. Next, such dosimetric properties as linearity, fading, humidity response, response from exposure at elevated temperatures, effect of the surrounding medium and energy response were studied. To detect the exo-electrons a gas flow proportional counter using 90% argon plus 10% methane counting gas was used. The TSEE analyzing system consisted of linear temperature programmer with a heating rate of 93°C/min. Pulses from the counter were recorded in a 400 channel multichannel analyzer operated in the scaling mode, an X-Y plotter, parallel printer and scaler. The dosimeters were prepared by plating the material on 1/2 in. diameter stainless steel planchets. Both pure LiF and LiF mixed with graphite in a 3:1 ratio by weight were studied. A maximum peak position was found at 135°C. The powders were stored in evaporating dishes for 24 hours in direct sunlight, dark storage and in low and high vacuums. There was a decrease in sensitivity for the powders stored in direct sunlight and under vacuum conditions. Powders were also stored for 88, 58, and 3 days in dark storage with no variation. Agitation and post annealing cooling rate were found to change the exo-electron emission. Grinding of the powder increased the sensitivity by up to a factor of 4 but not reproducible. Faster post annealing cooling rates gave an increased exo-electron emission. A maximum sensitivity of 2100 counts/R was obtained by preheating the powder to 450°C for 30 minutes. Humidity and predosing factors were found to have no effect on the exo-electron emission. Exposures as high as 3×10^3 R with ^{60}Co gamma radiation were used, followed by annealing and exposure to 13.2 R. Linearity of response to dose was found to be from 100 mR to 100 R for pure LiF and 100 mR to 700 R for LiF/C. Both dosimeters became non-linear after reaching 100 R and 700 R, respectively. Fading was undetectable for the first 10 hours with 25% fading occurring in 5 weeks. Fading at an elevated temperature of 50°C resulted in a 50% loss of emission within ten hours. A study was conducted at 50°C with relative humidities of 45 and 92%. No variation in fading rate between the two humidity levels was detected. Elevated temperature exposures were conducted by exposing dosimeters to 13.2 ^{137}Cs gamma radiation in a range from 25 to 95°C. The total exo-electron emission gradually decreased with a minimum emission of 28% of the original emission at 95°C. The photon energy response was studied by exposing the LiF/C dosimeters to effective X-ray energies ranging from 16.5 to 182 keV, and 662 keV (^{137}Cs) and 1250 keV (^{60}Co). The response was about half way between the theoretical LiF and C energy response curves. (WHK)

11380 READER FOR RADIOTHERMOLUMINESCENT DOSIMETER. Chenault, R.; Prigent, R. (to Commissariat a l'Energie Atomique). US Patent 3,852,589. 3 Dec 1974. Priority Date 5 Dec 1969, France. 4p.

The reader comprises a photomultiplier and three operational amplifiers connected in cascade. The first amplifier provides the glow curve. The second amplifier may operate either as an integrator or as a second linear amplification stage. The third amplifier provides the peak value of the luminescence curve. (Official Gazette)

11381 FURTHER CONSIDERATION OF THE TRACK–INTERACTION MODEL FOR THERMOLUMINESCENCE IN LiF(TLD–100). Attix, F.H. (Radiation Technology Division, Naval Research Laboratory, Washington, D.C. 20375). J. Appl. Phys. 46: No. 1, 81-88 (Jan 1975).

At the Second International Conference on Luminescence Dosimetry in Gatlinburg in 1968 Claffy, Klick, and Attix introduced the track–interaction model in an attempt to explain the phenomena of supralinearity and sensitization generally observed in the thermoluminescence of LiF(TLD–100). Their proposal in general terms was that the electron–hole traps are located near the paths of the energetic charged particles (primary or secondary) which traversed the

crystal during ionizing irradiation, and that this nonrandom spatial distribution affects the thermoluminescence process both with respect to its dependence upon dose and upon linear energy transfer. Moreover the observed sensitization of the phosphor, after receiving a large radiation dose followed by a partial annealing, was attributed to the survival of luminescence centers. In the present work a very simplistic model has been adopted for purposes of estimating how the average distance between luminescence centers along a charged-particle track compares with the average distance between tracks. Magnesium centers, occurring at ≃68-Å intervals, are assumed to provide trapping sites both for electrons and holes. The luminescence centers are taken to be *F* centers associated in some way with the titanium centers which occur at ≃127-Å intervals. For the Compton secondary electrons resulting from ^{60}Co γ-ray interactions, the average separation of ionizing events along the track is ≃350 Å, and the average separation of *F* centers is ≃2300 Å, resulting from about every seventh ionizing event. The average separation of tracks for a γ-ray exposure of 10^3 R is ≃660 Å, which is roughly the same as the average separation of trapped charge carriers along a given track from their nearest *F* center in the same track. This is the same exposure level at which supralinearity of TL response vs exposure begins to appear for ^{60}Co γ irradiation. The more densely ionizing tracks of heavy charged particles are shown to be much more widely separated relative to the luminescence center intervals in each track; thus supralinearity should not be expected in that case, in agreement with observations. An important feature of this paper is the estimation of an energy budget for LiF(TLD-100), beginning with the deposition of ^{60}Co γ-ray dose in the crystal, and terminating in the emission of 0.04% of that energy as thermoluminescence. Reasonable avenues are suggested by which the energy losses may occur, and estimates are made of the energy fraction in each category, based on available evidence. (auth)

11382 $CaSO_4$:Dy AS A THERMOLUMINESCENT PHOSPHOR. Giessing, R. (VEB RFT Messelektronik, Dresden); Linemann, H.; Schmidt, K. Isotopenpraxis; 10: No. 9, 340-341(Sep 1974). (In German).

Preparation and dosimetric properties of a thermoluminescent phosphor on the basis of $CaSO_4$ are dealt with. The influence of the Dy-content on important properties is represented. The comparison with other thermoluminescent phosphors shows the high response of the $CaSO_4$:Dy phosphor. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstract 12148.

11383 (AD-784402) EXPLORATORY TESTS OF A CURVED-CRYSTAL X-RAY SPECTROGRAPH FOR DIAGNOSTICS OF THE CASINO SPECTRUM. Final Report. Birks, L. S.; Dozier, C. M.; Sandelin, J. W.; Johnson, E. T.; Brown, D. B. (Naval Research Lab., Washington, D. C. (USA)). Jul 1974. 13p. (NRL-MR-2842) NTIS $3.00.

Exploratory tests were carried out with the curved-crystal spectrograph and tantalum foil targets using the 1 MeV electron Van de Graaff and the Gamble I facilities. Characteristic Ta K alpha lines were readily observable with 0.1 Coulomb irradiation on the electron Van de Graaff or with one shot on Gamble I. Good Ta bremsstrahlung spectra required longer exposures as would be expected; faster film intensifying screens would reduce exposure requirements by two to five times. Ancillary tests included a balanced-filter experiment to measure Ta characteristic radiation independently of the crystal spectrograph and the use of secondary fluorescers excited by primary x-rays from the Ta target. (auth)

11384 (IS-3460) SKEWGAUS: A FORTRAN PROGRAM FOR FITTING PEAKS IN SEMICONDUCTOR DETECTOR SPECTRA. Schick, W. C. Jr. (Ames Lab., Iowa (USA)). Oct 1974. Contract W-7405-eng-82. 94p. Dep. NTIS $5.75.

A FORTRAN program has been devised to fit a skewed-Gaussian line shape to peaks in multichannel analyzer (MCA) spectra obtained with Ge(Li) and Si(Li) semiconductor detectors. The fitting function has been found to represent very accurately the peak shapes obtained under a wide variety of experimental conditions, yet it is simple enough to be easy to use. Multiplet fits with up to nine component peaks may be handled. Parameters of different peaks may be constrained to vary proportionately during the fit. Different convergence criteria are applied to different peak parameters. Several options are available for handling the background, permitting it to be fit either concurrently with the peaks or separately. A modified statistical weighting of the MCA data points is available to take into account the differential nonlinearity of the analyzer. The program has been designed to supply its own initial estimates for nearly all parameters, so that the amount of input data the user must supply is minimal, unless he wishes to override the standard default options. Program output may be in graphical, punched card, and printed form, including an optional capsule summary output of the essential results of all fits performed in one execution of the program. (auth)

11385 (JINR-11-7319) ONE-WAY COMMUNICATION TRIDAC-C-MINSK-2. Aleksandrov, V. S.; Vylov, Ts.; Zaidler, Z.; Fominykh, M. T.; Muminov, T. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 11p. (In Russian). INIS.

A one-way TRIDAC-C-Minsk-2 communication was set up. The circuit changes in the Minsk-2 computer and in the RG-23 magnetic recorder of the TRIDAC-C system are described. The communication was successfully used during measurement of the radiation spectra of radioactive nuclides. (tr-auth)

11386 (JINR-13-7288) TWO-PARAMETER ANALYZER WITH DIGITAL WINDOWS ON LINE WITH A SMALL COMPUTER TRA-1001. Nefed'ev, O. K.; Shul'tse, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1973. 14p. (In Russian). INIS.

A system of multiparameter measurement for nuclear-spectroscopic studies on the beam of the heavy ion accelerator U-300 is described. The system consists of a measurement apparatus for studies of γ-γ coincidences and lifetimes of nuclear levels and of recording devices. In the recording device there is a two-parameter analyzer with digital windows operating on-line with the small computer TRA on a channel of direct access to the operative memory of the computer. Part of the computer memory is used for control programs, programs for visual representation of data, and for the acquisition and preliminary processing of measurement results during the experiment. (tr-auth)

11387 (KFK-2021) EXPERIMENTAL AND THEORETICAL ASPECTS OF HIGH RESOLUTION NEUTRON SPECTROSCOPY. Cierjacks, S. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Apr 1974. 32p. (CONF-740419-3). Dep. NTIS (US Sales Only) $4.75.

From 2nd international school on neutron physics; Alushta, USSR (2 Apr 1974).

Present experimental conditions for high-resolution neutron spectroscopy are discussed on the basis of recent developments in neutron spectrometers using a continuous-energy-spectrum source. Particular consideration is given to the isochronous cyclotron time-of-flight spectrometer. As an example of this type of facility, the fast-neutron spectrometer at the Karlsruhe cyclotron is briefly described. Present specifications of the time-of-flight apparatus are given. To demonstrate its capability for high-resolution neutron investigations a few examples of recently obtained results are given. Some theoretical aspects of high-resolution neutron spectroscopy are considered in some detail. A new method is discussed which allows an unambiguous assignment of resonance spins and parities by combining results from both high-resolution total and a few angle elastic scattering experiments. The implications of this method for the determination of accurate resonance parameters are examined. The appearance of intermediate structure phenomena in fast-neutron excitation functions is demonstrated. Its possible interpretation in terms of doorway structure is discussed. (16 figures, 2 tables) (auth)

11388 GERMANIUM DETECTORS FOR LOW-ENERGY GAMMA RAYS PREPARED BY ION IMPLANTATIONS. Chwaszczewska, J. (Inst. of Nuclear Research, Swierk, Poland); Czarnacki, W.; Szymczak, M.; Latuszynski, A.; Maydell-Ondrusz, E. Nukleonika; 19: No. 10, 899-904(1974).

A method is described for preparing germanium detectors for low energy (3 keV to 120 keV) gamma radiation and their spectral characteristics are presented. The p^+ contact was prepared by implanting a dose of about 10^{14} cm^{-2} of 20 keV gallium ions. The spectrometer resolution achieved was 405 eV for the manganese x-rays MnK_α (5.9 keV), 450 eV for the silver X-rays AgK_α (22.16 keV), and 550 eV for the γ-ray 122 keV (^{57}Co). (auth)

11389 SPECTROMETER BASED ON THE SILICON SEMICONDUCTOR DETECTORS FOR A STUDY OF THE TWO CHARGED PARTICLES CORRELATION. Krumsztein, Z. W.; Siemiarczuk, T.; Szawlowski, M. (Joint Inst. for Nuclear Research, Dubna, USSR). Nukleonika; 19: No. 10, 851-860(1974). (In Russian).

The spectrometer based on the silicon semiconductor detectors for a study of the correlation between two charged particles is described. The results of the time resolution and particle identification measurements are presented. The tests were performed in the proton beam of the JINR synchrocyclotron. (auth)

11390 ROTATING CRYSTAL TIME OF FLIGHT SPECTROMETER USING A PULSED NEUTRON SOURCE. Egelstaff, P. A.; Graham, W. G.; Hahn, L.; Susuki, K.; Winfield, D. J. (Univ. of Guelph, Ont.). Can. J. Phys.; 52: No. 21, 2093-2107(1 Nov 1974).

The design and construction of a rotating crystal spectrometer for use with a pulsed neutron source is described. The source is the tungsten target of a 33 MeV electron linear accelerator, and at 5 kV mean power the spectrometer performance is equivalent to that of a similar instrument mounted on a nuclear reactor of 4×10^{12} n/cm^2 s flux. Future developments will give an order of magnitude overall improvement. This spectrometer has been shown to be useful for studies of dense gases and liquids using an incident neutron wavelength of 2.4 Å, and its performance at wavelengths between 0.5 and 6.2 Å has been assessed. (auth)

11391 COUNT RATE DEPENDENCE OF NARROW WINDOWS IN GAMMA SPECTROMETERS. Yadav, H. S. (Inst. of Nuclear Medicine and Allied Sciences, New Delhi). pp 73-78 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

In gamma-ray spectroscopy the normal optimum settings are usually a 10 to 15 percent window over the baseline which will cover around 85 percent of the area of the photopeak and maximize the S^2/B ratio. However, a significant shift in the position of the photopeak is noticed at very high count rates due to a reduction in gain of the system. The window width would therefore play a role in the estimation of the activities and error can arise when varying activities are measured with too narrow a window. Some experimental data concerning the influence of the drift in gain with activity measurements are described. The question of optimum window setting when either a wide range of activities of the same isotope has to be measured or a mixture of varying quantities of two isotopes of different energies are to be counted are discussed. (auth)

11392 PROCESS AND DEVICE FOR PHOTOMULTIPLIER GAIN STABILIZATION. Chevalier, P.; Seeman, B. (to Societe de Prospection Electrique Schlumberger). French Patent 2,168,849. 24 Jan 1972. 7p. (In French).

The mean output current of the photomultiplier is kept at a constant level by compensating for the variation thereof through changing the illumination of the photocathode. To this end, a photoemitter diode is coupled to the latter said diode being fed by a current which is a function of the difference between the photomultiplier mean anode current and a reference current at least equal to the peak value of the latter. (FR)

11393 IMPROVING THE RESOLVING POWER OF AN END-TYPE PROPORTIONAL COUNTER FOR RECORDING SOFT GAMMA RADIATION. Beda, A. G.; Davydov, A. V. (Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 909-910(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 237(1974).

It is demonstrated that the transition from the method of mounting a filament which is used in conventional SRT-2 counters to a procedure by which its front end is attached directly to the window of the counter leads to an improvement of the resolving power by up to ~30% at a γ-ray energy of ~14 keV. (auth)

11394 SPECTROMETER FOR MEASURING SAMPLE RADIOACTIVITY. Thomas, E. W.; Rapkin, E. (to Intertechnique). French Patent 2,168,315. 5 Jan 1973. 21p. (In French).

This spectrometer is adapted to measure the activity of various radioisotopes contained in samples, the energy spectra of which are different (iodine-131, cesium-137, tritium, phosphorus-32). The spectrometer is provided with (a) detection means (thalium activated sodium iodide scintillators or liquid scintillators) for generating, in response the radioactivity events occurring in the samples, electric pulses the amplitude of which is substantially in proportion to the energy of the radiation emitted at the moment of a given event (b) means for amplifying electric pulses comprising a plurality of stepped linear amplification stages each of which has a determined gain (c) at least in counting channels each of which is provided with counting means, and (d) an amplitude selector adapted to transmit to said counting means only those electric pulses the amplitude of which is located in a given window characterized in that each channel is provided with a selector adapted to connect the analyzer input with the output of any of several amplification stages. (FR)

11395 USE OF A LARGE-DIAMETER SCINTILLATION DETECTOR IN X-RAY SPECTROMETRY WITH HORIZONTAL FOCUSING. Al'perovich, V. R.; Grinberg, N. B.; Lenin, S. S.; Serikov, I. V. App. Metody Rentgenovskogo Anal.; No. 13, 172-175(1974). (In Russian).

It is shown that the use of a scintillation detector 40 mm in diameter increases the intensity of radiation that can be collected and counted. The intensities registered by detectors 16, 40 and 60 mm in diameter are in the ratio of 1.0 to 2.2 to 2.7 respectively. It is possible to register a series of lines at one fixed position of the crystal analyzer. The basic parameters of the detection unit are enumerated. (SJR)

11396 LOW LEVEL γ-RAY SPECTROMETRY; NaI(Tl) vs. Ge(Li). Robertson, R. (Univ. of Surrey, Eng.); Spyrou, N. M.; Kennett, T. J. Anal. Chem.; 47: No. 1, 65-70(Jan 1975).

In the comparison of a 42 cm^3 Ge(Li) and a standard 7.6 × 7.6 cm NaI(Tl) detector for the γ-ray spectrometry of low intensity, non-complex sources, it has been shown that there exists some source intensity, $I_{critical}$, for which two compared detection systems yield identical precision for identical count time. $I_{critical}$ was found here to be ~1 photon sec^{-1} between 140 and 1600 keV. Below this intensity, the Ge(Li) system always yields superior precision whereas above $I_{critical}$ the NaI(Tl) system is ascendant. This result is contrary to that expected using arguments based on counting efficiency considerations alone. Optimum peak integration limits have been derived for low signal-to-noise ratio conditions assuming a Gaussian peak shape. Even in the most unfavorable case, where the signal-to-noise ratio is approaching zero, integration should be performed across at least 84% of the peak area, i.e., between limits of ±1.4 σ, for maximum precision. This result differs from that derived by Heydorn and Lada for photopeak integration by the method of Covell. (auth)

High Energy Physics Instrumentation

Refer also to abstract 12212.

11397 (BNL-18336) SAFETY EVALUATION REPORT: 7-FOOT BUBBLE CHAMBER FACILITY. (Brookhaven National Lab., Upton, N. Y. (USA)). Aug 1973. 384p. Dep. NTIS $22.25.

An evaluation of the design, fabrication, and operation of the BNL superconducting 7-foot hydrogen bubble chamber with regard to all aspects of the special hazards associated with it is given. Principle hazards identified: flammable fluid hazards, equipment hazards, external hazards, other hazards, and operator error. The maximum credible accident is analyzed. The safety criteria for the site and structures and facilities are itemized. The design and safety analysis of the component parts including the hydrogen chamber system, vacuum tank, flammable gas disposal system, magnet system, optics system, expansion system, and instrumentation are examined. Also, the operating procedures, training, and administration are discussed. (WHK)

11398 (IFVE-SEF-73-1) DISTRIBUTED RESISTOR UNIT FOR WIRE SPARK CHAMBERS. Vlasov, L. G.; Grigor'eva, E. V.; Konstantinov, V. F.; Pavlov, V. T.; Prokhorov, A. N.; Simonov, Yu. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 7p. (In Russian). INIS.

The construction and fabrication technology of a distributed resistor unit, designed for wire spark chambers, are described. The resistors were used for connecting the wires of high-voltage electrodes of spark chambers with the pulsed power supply. The wire spark chambers with distributed resistor units were developed on the beam of the IHEP particle accelerator and exposed to more than 10^6 triggerings during the year. Significant changes of the characteristics were not observed. (INIS)

11399 (IFVE-SPK-73-33) OPTIC PROBLEMS OF CATHODE RAY TUBES. Utochkin, B. A.; Tsyganenko, V. V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 27p. (In Russian). INIS.

The electron-optical characteristics of a translucent cathode ray tube with high resolving capacities were analyzed on the basis of the constant-frequency characteristics method, widely used in light optics. The cathode-ray tube was used in computers for processing bubble chamber photographs. The analysis results were compared with experimental data. Satisfactory agreement was obtained. (tr-auth)

11400 (IFVE-SPK-73-67) HAZAR PROGRAM FOR EVENT GEOMETRIC RECONSTRUCTION IN BUBBLE CHAMBERS. Ammosov, V. V.; Gerdyukov, L. N.; Gorichev, P. A.; Ivanova, N. S.; Kistenev, E. P.; Klimenko, S. V.; Shcherbakov, F. D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 17p. (In Russian). INIS.

The HAZAR program for the geometric reconstruction of events in bubble chambers of the classical type is described. The algorithms of the THRESH and TVGP programs are basically used; however, the organization of the programs, the structure of the memory distribution, and some of its computational procedures are substantially different. The HAZAR program in the first place is designed for the processing of photographs of bubble chambers with heavy liquids but can also be used for hydrogen chambers. (tr-auth)

11401 (IFVE-SPK-73-93) LIBRARY OF THE STANDARD SUBPROGRAMS-GENERAL SECTION. Belokopytov, Yu. A.; Petrovykh, L. P.; Khvorostyanov, A. G. 1973. 7p. (In Russian). INIS.

The standard subprogram library, General Section, working in the 1906A computer is described. Subprograms necessary for the operation of the program of the IHEP bubble chamber photograph processing system are included in the library. (tr-auth)

11402 (IFVE-SPK-73-96) BUFFER MEMORY DEVICE FOR THE NRD SCANNING SYSTEM. Gerasimov, R. Ya. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 12p. (In Russian). INIS.

The buffer memory is constructed of solid integrated circuits, each of which contains 16 single-discharge words. The trigger, constructed of two 4-emitter transistors, is the memory element. The processes of entry and readout are done by principles analogous to those used in core memory with rectangular hysteresis loop. The memory device used in the NRD scanning system is described. The method of construction and the structural and principal circuits are briefly examined. Experimental data on the operation of the memory are also reported. (tr-auth)

11403 (JINR-1-8105) DETERMINATION OF THE DETECTOR CHARACTERISTICS AND RESTORATION OF OTHER PARAMETERS NECESSARY FOR THE CORRECT CALCULATION OF THE SPECTROMETER EFFICIENCY IN EXPERIMENTS ON $\pi-e$ SCATTERING AT 50 GeV. Adylov, G. T.; Gaevski, V.; Vodop'yanov, A. S.; Nigmanov, T. S.; Tsyganov, E. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 16p. (In Russian). INIS.

The dependence of the efficiency of a spark chamber on the number of background tracks in it was determined. It was found that the probability of the simultaneous recording of two tracks, if the distance between them is 2 to 3 mm, decreases by 50%. By means of a program for searching for background tracks, the background load of experimental sessions was reduced. These data were corrected with information from a proportional chamber. (tr-auth)

11404 (JINR-10-7190) PROGRAM OF CALCULATION AND FORMATION OF CONTROLLING INFORMATION FILE FOR THE SCANNING AUTOMATION. Ivanchenko, Z. M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 11p. (In Russian). INIS.

A brief description is given of the MIST program which calculates and stores in a suitable format data necessary for controlling the operation of HPD-type scanning computers. It filters the scanning results and processes the measurements according to geometric reconstruction and kinematic analysis programs. The program was verified on photographs made with the 2 m hydrogen chamber TsERN and the 1 m hydrogen chamber LVE. The time for processing one event is 0.5 sec. (INIS)

11405 (JINR-10-7612) METHOD FOR THE AUTOMATIC TRACK DETECTION IN A PROPANE CHAMBER. Moroz, V. I.; Nikitina, V. I.; Tentyukova, G. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 12p. (In Russian). INIS.

A track detection method using the theory of graphs is examined. A program using this method was developed for track detection measured in 2 to 6 stereocomponents. There is a unit for the determination of the optimum stereopairs. The program is written in Fortran for the BESM-6 and is correlated with the geometric reconstruction program I-8. (tr-auth)

11406 TRACKS OF IONIZING PARTICLES IN LIQUID HYDROGEN ULTRASONIC BUBBLE CHAMBER. Akulichev, V. A.; Grebinnik, V. G.; Zukov, V. A.; Kopova, A. M.; Krasil'nikov, V. A.; Manych, A. P.; Selivanov, G. I.; Yushin, V. P. (Inst. for Acoustics, Moscow). Dokl. Akad. Nauk SSSR; 216; No. 3, 517-519(21 Mar 1974). (In Russian).

The basic results of the experimental study of a liquid hydrogen ultrasonic bubble chamber for the detection of ionizing particle tracks are reported. This type bubble chamber can register particle tracks without use of any of the usual mechanical expansion systems because of the ultrasonic field imposed. The studies showed that the absorption of the ultrasonics imposes limitations on the size of the ultrasonic field in the working volume of the bubble chamber. (JSR)

Radiometric Instruments

Refer also to abstracts 11513 and 12219.

11407 (AD-784033) FEASIBILITY STUDY OF X-RAY GAGING FOR ON-LINE TESTING OF SHELL CASES FOR SCAMP (SMALL CALIBER AMMUNITION MODERNIZATION PROGRAM) PROJECT. Final Report. Piazza, A. C. (Texas Agricultural and Mechanical Univ., College Station (USA)). Mar 1973. 41p. (USAMC-ITC-2-73-17). NTIS $3.25.

The purpose of this research is a feasibility study of x-ray gaging for on line testing of shell cases for project "SCAMP". The advantages and disadvantages of solid state x-ray gaging are qualitatively discussed and quantitatively weighed. It is concluded that solid state x-ray gaging of production line products at high speed is now coming into its own with the use of minicomputers and shows great promise for use on the "SCAMP" project. (auth)

11408 (AD-784612) COMPUTED ENERGY DISTRIBUTION OF DOUBLE-SCATTERED PHOTONS, OBTAINED FOR PURPOSES OF MINE DETECTOR DESIGN ANALYSIS. Final Report. Roder, F. L.; Conley, D. G. (Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. (USA)). Apr 1974. 20p. (USAMERDC-2097). NTIS $3.00.

The spectrum of x and gamma radiation backscattered from a scattering medium is a function of the chemical composition of that medium. Photon backscatter has, therefore, received considerable attention over the past several years (in both applied research and advanced development) as a possible technique for detecting shallowly buried, nonmetallic mines. This report concerns one aspect of this investigation. (GRA)

11409 (CEA-R-4577) DEVELOPMENT OF ELECTRON CAPTURE DETECTORS USING TRITIATED AND NICKEL 63 SOURCES. Steinschaden, K. (CEA Centre d'Etudes Nucleaires de Saclay, 91— Gif-sur-Yvette (France). Dept. des Radioelements). Nov 1974. 43p. (In French). Dep. NTIS (US Sales Only) $5.25.

The principles of gas chromatography and electron capture detection are outlined and the results of tests on tritiated-source and nickel-63 source detectors are presented. Original detectors have been designed, the user adapting the interelectrode distance to the nature and concentration of the chemical species analyzed. A quantity as small as 5×10^{-13} g of lindane can be detected with the tritium detector and 10^{-12} g with the nickel detector. It should be possible to measure smaller amounts by adapting the rest of the apparatus, e.g., column and injector, amplifier and recorder, and pulse generator. The detectors are especially well suited to the analysis of chlorinated insecticides, i.e., D.D.T., aldrine, dieldrine, lindane. (auth)

11410 (IFA-TEN-1-1974) BASIC CONCEPTS IN RADIOMETRIC PROCEDURES. Ciobanu, E.; Rebigan, F. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 26p. (In Rumanian). Dep. NTIS (US Sales Only) $4.50.

A review is made of the basic concepts and notions commonly used in measuring techniques as well as the general principles of the treatment of experimental data obtained with radiometric devices. An attempt is made in order to clarify and define some interesting concepts such as standardization and calibration, precision and accuracy, and so on. These are critically presented and adequately adapted to meet modern needs. Attention is drawn to a complete characterization of the radiometric devices in terms of metrological (physical), technical, and radioprotection quantities. (auth)

11411 DETERMINATION OF BOREHOLE WASHOUT BY USE OF INELASTIC NEUTRON SCATTERING GAMMA RAY MEASUREMENTS. Schultz, W. E.; Smith, H. D. Jr. (to Texaco Inc.). US Patent 3,838,279. 24 Sep 1974. Filed Date 3 Apr 1973. 10p.

An illustrative embodiment of the invention provides a method for locating zones of borehole washout behind the casing in a cased well borehole. The formations in the vicinity of the borehole are repetitively irradiated with short duration bursts of fast neutrons. Gamma rays produced by the inelastic scattering of the fast neutrons are observed in at least four different energy regions in the gamma ray spectrum and are corrected for any lingering thermal neutron capture gamma ray background. The four energy regions include inelastic scattering gamma rays from carbon, oxygen, silicon and calcium. A first output signal related to the porosity (hydrogen index) is derived by summing the inelastic gamma rays in all four energy regions. Second and third output signals are formed by taking the carbon/oxygen and silicon/calcium ratio signals. The three output signals are then combined according to predetermined empirically derived relationships to produce an estimate of the location of zones of borehole washout behind the casing. (Official Gazette)

11412 WATER IN ROADS: METHODS FOR DETERMINING SOIL MOISTURE CONTENT AND PORE WATER TENSION.

A Report Prepared by an OECD Initiated Road Research Group, December 1973. Paris; Organization for Economic Co-Operation and Development (1973). 63p.

Determination of moisture content in road substructures and subgrades together with results of other tests are a way of characterizing a soil and determining its consistency index, porosity, unit weight, etc. Moreover, knowledge of the moisture content gives an indication of the compactibility of soils which is related to a specific range of moisture, of the consistency of cohesive soils and their compressibility and load bearing capacity. There is also no doubt about the value of moisture content determination and control as regards roads under construction. A brief survey of all relevant destructive measuring methods as far as construction sites are concerned is given. These methods are primarily used in specimen testing for planning and control of construction work. The report lays most stress on non-destructive measuring methods which can be used in situ for determining moisture content, negative pore water pressure and the reasons for their presence. Certain methods of special interest for laboratory work are added. The conclusions and a critical summary evaluation of all the methods described are presented. (FR)

11413 RADIATION INSPECTION APPARATUS WITH ADJUSTABLE SHUTTER FOR INSPECTING DIFFERENT SIZES OF TUBULAR GOODS. Kahil, J. E. US Patent 3,835,323. 10 Sep 1974. Filed date 7 Aug 1972. 20p.

In the new and improved radiation apparatus for inspecting tubular goods, a radiation detector is arranged on a selected inspection axis for receiving radiation from a uniquely-arranged radiation emitter facing the detector and rotating about the exterior of the tubular member as it is translated along the axis around the detector. In the preferred embodiment disclosed herein, this unique radiation emitter includes an array of side-by-side radioactive sources aligned with laterally-spaced focussing passages for producing a composite radiation pattern formed by a number of individual sharply-defined radiation patterns on opposite sides of the inspection axis as well as intersecting the axis. The emitter further includes a selectively-positionable radiation controller which is arranged for movement between one position for emitting only a single radiation beam of selected intensity to produce a radiation pattern of reduced size and another position for emitting radiation beams from all of the sources to produce the composite pattern across the inspection axis. (Official Gazette)

11414 PROCESS FOR THE REMOTE ANALYSIS OF THE CHEMICAL COMPOSITION OF A MEDIUM AND DEVICE MAKING USE OF THIS PROCESS. Brafman, M.; Godeau, A.; Laverlochere, J.; Lecomte, J. L. (to Commissariat a l'Energie Atomique). French Patent 2,168,238. 21 Jan 1972. 13p. (In French).

According to the invention the radiations generated by the medium to be analyzed or due to the energization of said medium by means of a pulsed neutron beam are collected by a probe formed of a pulsed neutron generator and of a scintillation detection chain. These radiations are converted into electrical signals and at least one of the data is digitally coded. The alternate digital signal is analyzed by an analyzer of the multichannel digital selector type. (FR)

11415 INVESTIGATIONS OF THE VIRTUAL DENSITY OF GRINDSTONE DISKS BY γ-ABSORPTION. Balla, B. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 466-469(1974). (In Hungarian).

Error calculations to improve the radiometric method are described. (auth)

11416 BASIC PRINCIPLES OF NON-CONTACTING LAYER THICKNESS MEASUREMENT. Stahl Eisen; 94: No. 17, 818-821 (Aug 1974). (In German).

5 figs.; 11 refs. Part of a paper presented at the seminar of the Unterausschuss fuer Oberflaechentechnik on Dec 12th, Duesseldorf, F. R. Germany.

The paper reviews the currently used densimeters and describes magnetic and eddy current methods, beta-backscattering and X-ray fluorescence analysis. (GE)

11417 FUNDAMENTAL STUDY ON INDUSTRIAL MEASUREMENTS BY MEANS OF BACKSCATTERED GAMMA-RAYS. II. Determination of Liquid Level Using Broadened Beams. Wakabayashi, N.; Goto, T.; Ueda, K. (Kobe Univ., Japan). Mem. Fac. Eng., Kobe Univ.; No. 20, 1-11(Mar 1974).

For use in on-off and follow-up types of level gages, the primary and/or scattered beams of gamma-rays were limited only to a horizontal plane between lead blocks in order to increase the counting rate from a given source without deterioration of the resolving power of level location. The gamma-ray source used was ^{137}Cs, and the detector was a NaI(Tl) scintillator shielded not only from the direct beam but also from the photons scattered once by the vessel wall. They were arranged horizontally or vertically. The effects of the gap width between the lead blocks in the horizontal arrangement and of the distance from the source and the detector to the vessel wall in the vertical arrangement on the difference between the counting rates for a full vessel and for an empty one as well as on the relative sensitivity at the level to be detected were measured. It is proposed that the accuracy of these level gages may be expressed by the minimum product of the radioactivity of the source and the time constant of the rate-meter circuit necessary to respond to a level change of unit length. From the values, it was found that the above-mentioned arrangements are better than those using a narrow beam reported in a previous paper, and that a horizontal arrangement with a narrow source gap, a wide detector gap, and short source and detector distances is the most suitable for the level gages. (auth)

11418 GAMMA RAY DIFFERENTIAL DENSITY PROBE. Kehler, P. (to Applied Invention Corp.). US Patent 3,846,631. 5 Nov 1974. Filed date 13 Mar 1972. 14p.

A gamma ray density probe and method utilizing a pair of alternately operated gamma ray sources, and a pair of gamma ray detectors is described. The density probe is able to measure differentially the density at a predetermined distance from the probe, independent of the geometry of the sample and of the geometry and the chemical composition of interfering materials by computing the product of the ratio and the inverse ratio of two counting rates. (Official Gazette)

11419 COATING THICKNESS GAUGE. Utt, O. L.; Evans, H. J. (to Industrial Nucleonics Corp.). US Patent 3,848,125. 12 Nov 1974. Filed date 20 Sep 1971. 16p.

Disclosed is a system for measuring the thickness of a zinc coating on an iron sheet wherein the coating and substrate are irradiated by a continuous x-ray beam source. The beam is propagated in a first or positive direction away from the source through a reference chamber to the coating and substrate. In response to fluorescence of the coating and substrate due to x-ray irradiation, secondary x-rays are derived and propagate in a second or negative direction generally towards the source. The intensity of the negatively directed x-rays is determined with a measuring chamber concentric with the reference chamber. The reference and measuring chambers include a noble gas that is ionized in response to the x-rays impinging thereon. Gases flow between the two chambers by a structure which prevents coupling of ions between the chambers, whereby the relative sensitivity of the two chambers is equalized. Responses from the two chambers are combined to provide a signal that is independent of intensity variations of the x-ray beam source. The combined signal is electronically processed to provide an output signal directly proportional to the zinc coating. Standardization of the gauge is performed by substituting first and second samples respectively having no and a predetermined amount of zinc on an iron substrate, for the sheet being measured for coating thickness. (Official Gazette)

11420 PULSED NEUTRON WELL LOGGING TECHNIQUES WITH BACKGROUND RADIATION REMOVAL. Pitts, R. W. Jr. (to Texaco Inc.). US Patent 3,842,265. 15 Oct 1974. Filed date 21 May 1973. 14p.

An illustrative embodiment of the invention includes a system for pulsed neutron well logging. A pulsed source of 14 MeV neutrons repetitively irradiates earth formations surrounding a borehole. Two time gates, an inelastic neutron scattering gamma ray gate and a background gamma ray gate pass signals from gamma ray detecting means to data processing circuitry during these selected time intervals. Four energy windows corresponding to carbon, oxygen, silicon and calcium inelastic gamma rays then pass the selected time count pulses falling in their respective energy ranges. During the background count time interval, background counts in each energy window are stored in memory means. During the inelastic gamma ray counting intervals the background counts are subtracted from the inelastic gamma ray counts to provide statistically enhanced counting data. These data may then be interpreted in terms of the properties of the earth formations and formation fluids in and about the borehole. (Official Gazette)

11421 IONIZATION CHAMBER WITH RECESSED RADIOACTIVE BODY. Larsen, L. D.; Kompelien, A. D. (to Honeywell Inc.). US Patent 3,849,685. 19 Nov 1974. Filed date 22 Jun 1973. 2p.

An improved chamber assembly for an ionization smoke detector is described. The chamber assembly includes a cup shaped electrode having attached therein a radioactive source to provide the ionization in the chamber. The radioactive body which is retained in a rivet head container, or the like, is staked to the

interior surface of the cup shaped electrode, and to make sure that the radioactive source or its container does not project out into the chamber area, the mounting point of the electrode is dimpled so that the face of the mounted radioactive rivet is substantially flush with the general contour of the interior surface of the electrode. (Official Gazette)

11422 RADIOLOGICAL WELL LOGGING METHODS AND APPARATUS FOR REDUCING THE EFFECT OF ACTIVATION FROM THE DETECTOR CRYSTAL. Arnold, D. M.; Pitts, R. W. Jr. (to Texaco Inc.). US Patent 3,842,264. 15 Oct 1974. Filed date 25 Sep 1972. 20p.

Improved radioactivity well logging methods and apparatus are provided for determining the macroscopic thermal neutron capture cross section of subsurface earth materials, wherein a correction is made to reduce or eliminate the effects of the portion of the measurement which is due to radiation produced by reactions of the residual fast neutron flux of the accelerator and the activation of the crystal in the detector. The high energy neutron source is pulsed at a preselected rate, during the first portion of the operating cycle, and the resulting capture-induced radiation is measured within the first portion of the operating cycle during two preselected time intervals following the termination of each neutron burst. Thereafter, the source is inactivated during the balance of the operating cycle, and a measurement is made of the radiations registering in the activated crystal. This latter measurement is then utilized to correct the measurements obtained during the first portion of the operating cycle to a predetermined relationship. (Official Gazette)

11423 PULSED NEUTRON CAPTURE LOGGING FOR DETERMINING RESIDUAL OIL. Robinson, J. D. (to Shell Oil Co.). US Patent 3,852,593. 3 Dec 1974. Filed date 10 May 1973. 6p.

A method for determining residual oil saturation in a formation using a pulsed neutron capture logger and making two measurements is described. The first measurement is made with the indigenous fluid in place and the second measurement being made with a portion of the indigenous fluid displaced. Each of the two measurements consists of two counting periods during which the number of gamma rays are counted. The first counting period of each measurement being at least 500 microseconds after the neutron pulse. (Official Gazette)

11424 GAMMA RAY DENSITY PROBE UTILIZING A PAIR OF GAMMA RAY SOURCES AND A GAMMA RAY DETECTOR. Kehler, P. (to Applied Inventions Corp.). US Patent 3,840,746. 8 Oct 1974. Filed date 13 Dec 1971. 12p.

A gamma ray density probe utilizing a pair of gamma ray sources and a gamma ray detection system which measures separately and then builds the ratio of the radiation scattered from each of the two sources is described. (Official Gazette)

11425 SELF CALIBRATING ISOTOPIC PRECIPITATION MEASUREMENT GAGE. Morrison, R. G. US Patent 3,843,887. 22 Oct 1974. Filed date 22 May 1972. 8p.

A snow density gage is described in which an isotopic source emits highly energetic gamma rays transmitted through attenuating materials to a given point at which energy discriminating detectors are located and an electronic circuit connected to the detectors establishes a continuously calibrated density measurement from which the water content in a snow field is determined. (Official Gazette)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 12184.

11426 (AD-783360) BIPOLAR MEDIUM-SCALE INTEGRATED CIRCUIT HARDENING. Volume I. Phase I. Final Report, 1 January–30 September 1973. Stehlin, R. A.; Devries, D.; Bean, K.; Hoffman, J.; Robbins, C. (Texas Instruments, Inc., Dallas (USA)). Apr 1974. Contract F29601-73-C-0048. 161p. (TI-03-73-88-VOL-1; AFWL-TR-73-293-VOL-1). NTIS $5.00.

The results of the shallow device fabrication indicate that low-power Schottky circuitry can be fabricated with full fan-out up to 10^{15} neutron/sq cm. Three profiles have been identified that use an arsenic emitter and a shallow base junction. Ion implantation is used to a high degree. A multilevel metal system with compatible SiCr thin-film resistors has been demonstrated. The improved dielectric effort did not result in a feasible process for this program, but it did demonstrate several fabrication processes that can lead to an improved dielectric process. (auth)

11427 (ORNL-tr-2854) AGING OF THERMOCOUPLES BY NUCLEAR RADIATION. Lucot, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. des Piles Experimentales). [nd]. Translation by M. Gerrard of DPE/SPE/69-253. 83p. Dep. NTIS $7.25.

The behavior of more than 300 stainless steel sheathed, magnesia insulated, Chromel/Alumel thermocouples irradiated in the French OSIRIS reactor for periods of 500 to 5000 hrs is reported. Failure rate statistics and causes are given. Attempts to restore failed junctions in situ by capacitor discharge were 50% successful. In-pile experiments were conducted on thermocouple errors using a "Colibri" type irradiation apparatus, i.e., a gamma-heated thimble in which the temperature can be controlled from 200 to 800°C by varying a helium–nitrogen gas mixture, and by additional electrical heating. Using this apparatus, the effect of parasitic currents and reduced electrical resistance of insulation in isolated junction thermocouples was studied. Currents increased with irradiation time and produced temperature errors of about 9°C at 580°C in long (5.4 m) couples and 0.5°C on short (0.4 m) couples. A compensating circuit is proposed to minimize errors. Electrical resistance of magnesia insulation was measured by a method using the parasitic currents and potentials measured between thermocouple loop and sheath. While the insulation resistance decreased 40% during a two-month irradiation, no effect on calibration was found. No change in thermocouple calibration greater than ±3°C was found for irradiation to a neutron fluence of 1.2×10^{21} n/cm^2 sec. The theories of laws of thermocouple behavior, of changes in composition with neutron transmutation, and of radiation-induced beta emission into insulators are developed. (auth)

11428 (PEM-11) NUCLEAR EMP: CABLE COUPLING AND SHIELDING MODEL. Erb, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 40p. Dep. NTIS $5.00.

This report deals primarily with certain governing equations and presentation of somewhat detailed parametric results for the assumed cable coupling and shielding model. The model includes separate conductors lumped into a solid homogeneous core with exterior shield and with terminating impedances for the internal conductors at both ends in the line receptor unit boxes. The model was programmed to provide core load currents at a receptor resulting from given currents induced in the cable shield. Parametric results which include effects of braids, gaps, lengths, cable faults, and impedances are presented. No details of development of equations or the computer program are included in this note. A few basic parameters, material properties, and specific transmission line constants are included as supplementary reference material. (auth)

11429 (PEM-13) NUCLEAR EMP: SHIELDING EVALUATION OF BRAIDED CABLE SHEATHS AND MULTICONDUCTOR CABLES USING PULSE TEST METHODS. Brown, G. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1974. 48p. Dep. NTIS $5.50.

Transmission line theory can be used to obtain an estimate of current induced on a system cable or conductor in order to ascertain extent of EMP protection required. Frequently a lossless line with resistive loads suffices to approximate the real situation. For complex transmission line models extensive computation is usually needed. Transmission line equations for EMP coupling, the general solution for currents in the frequency domain, and handy formulas for calculation of currents in the lossless line are presented along with some experimental comparisons. (auth)

11430 (PEM-20) NUCLEAR EMP: PRACTICAL DESIGN PHILOSOPHY FOR MECHANIZATION OF WEAPON SYSTEM REQUIREMENTS. Bernier, G. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 16p. Dep. NTIS $4.00.

A practical design philosophy is provided for mechanization of weapon system electromagnetic pulse [EMP] requirements by program management personnel. The EMP environmental requirements are treated in terms of their gross impact on system design and the actual system tests that are currently employed to verify weapon system EMP survivability/vulnerability characteristics. Emphasis is placed on design areas that have a significant bearing on the transfer of EMP energy through weapon system shielding. EMP design requirements and performance verification tests are handled at the system, subsystem and discrete component level. The most effective types of analysis to employ for the various levels of system complexity are discussed in terms of the economic trade-off between analysis and testing. Subsystem package testing has merit in disclosing potential weaknesses in performance, supplying interface requirements, and serving as a production control tool. System tests include model, functional, and proof tests. (auth)

11431 (PEM-21) NUCLEAR EMP: SEMICONDUCTOR CIRCUIT FAILURE AND PROTECTION IMPLEMENTATION SCHEMES. Sinclair, R. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 16p. Dep. NTIS $4.00.

The transient pulse failure mechanism in semiconductor devices and thermal models for heat generation and transfer within the device are described. From these, formulas and criteria are developed to enable calculation of the critical energy for permanent damage. This is the applied pulse energy necessary for device failure. From these results, device protection criteria are developed. Protection resistor values can be calculated which permit protection of devices for specified critical energies and applied energy levels. Practical application of these protection criteria and specific examples are illustrated. Some consideration is given to the use of filters as protection devices. Filters are most effective in applications in which pulses cause circuit temporary malfunction. However, some degree of protection is provided by the filter against permanent damage. (auth)

11432 (PEM-25) NUCLEAR EMP: SUMMARY OF EMP CONTROL MANAGEMENT FOR THE B-1 AIRCRAFT. Stevens, D. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 33p. Dep. NTIS $4.75.

This report summarizes the management philosophy and techniques used to assure that the B-1 will be a weapon system which can withstand electromagnetic pulse (EMP) transients from nuclear explosions. The EMP control management philosophy and techniques dissertation is broken down into technical considerations impacting the philosophy, interdisciplinary communication channels involved, and cost-effectiveness considerations. The EMP environment was determined in terms of the EMP fields generated and how this field was transferred to the B-1. Then a determination was made of the coupling from the B-1 skin to inside the airframe and onto potentially vulnerable avionics and electrical subsystems. From this, an approach was made to counter EMP among various parts of the B-1. This apportionment process entailed the cost-effectiveness trade evaluations of candidate solutions which could be made and determining which were the best to meet total system requirements. (auth)

11433 (PEM-26) NUCLEAR EMP: OVERALL DESIGN PRACTICES, TESTING PHILOSOPHY, AND MANAGEMENT PLAN IN THE EMP HARDENING APPROACH FOR THE B-1 AIRCRAFT. Stevens, D. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 69p. Dep. NTIS $6.50.

This report includes the overall design practices, testing philosophy and management plan employed in the EMP hardening or protection engineering approach for the B-1 aircraft. After estimating aircraft skin current induced by the free-field EMP, protection design proceeds on the basis of a common mode transient current on each wire bundle as the most significant coupling. Hardware aspects such as shielded compartments, joints, assemblies, finishes, connectors, cables, and conduits are described. Test methods for connectors, cables, and conduits, and testing guidelines for individual units are presented briefly. A detailed discussion of the management, organization, and procedures involved in the B-1 survivability and vulnerability plan comprises a major portion of the material presented. (auth)

11434 (PEM-27) NUCLEAR EMP: GENERAL SOLUTIONS AND SIMPLIFIED FORMULAS FOR CALCULATING EMP INDUCED CURRENTS IN LOSSLESS TRANSMISSION LINES. Brown, G. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 13p. Dep. NTIS $4.00.

Transmission line theory can be used to obtain an estimate of current induced on a system cable or conductor in order to ascertain the extent of EMP protection required. Frequently a lossless line with resistive loads suffices to approximate the real situation. For complex transmission line models extensive computation is usually needed. Transmission line equations for EMP coupling, the general solution for currents in the frequency domain, and handy formulas for calculation of currents in the lossless line are presented along with some experimental comparisons. (auth)

11435 (PEM-28) NUCLEAR EMP: CONSIDERATIONS AND TECHNIQUES IN ALLOTMENT OF EMP PROTECTION REQUIREMENTS TO SUBSYSTEM END ITEMS IN WELL-SHIELDED GROUND-BASED SYSTEMS. Dahnke, J. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 10p. Dep. NTIS $4.00.

A general methodology for allotting or apportioning EMP protection in a well-shielded ground-based system involves understanding the system mission, defining the survivable elements, establishing the extent of a protective envelope and the threat at this envelope, associating the location of survivable elements with respect to this envelope, and then establishing hardening requirements in volts and amperes at the electrical projections beyond the envelope. A design iteration process is usually needed then to establish the limiting or filtering and amount of decoupling needed for lines leading into sensitive electronic elements. It is necessary also to establish electronic subsystem requirements, and practices such as buffering, current limiting, periodic reset, saturation, and good circuit layout may be employed. There is no magic organizational structure, but several factors such as good communications, early establishment of requirements, and knowledge of all system design constraints are important for success. This note provides discussion and guidelines in all of the above areas. (auth)

11436 (PEM-29) NUCLEAR EMP: COORDINATION OF LIGHTNING AND EMP PROTECTION IN AIRBORNE SYSTEMS DESIGN. Robb, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). [nd]. 55p. Dep. NTIS $5.75.

Airborne systems may require both lightning and EMP protection; however, failure to coordinate both of these protection areas can result in failure of one or both in the real environment. Addition of uncoordinated EMP protection devices can result in critical structural failure from lightning strokes as illustrated in the extensive histories of flight damaged aircraft which had no protection. Coordination of the protection should begin in preliminary design reviews and be carried through all design phases and acceptance testing. Long experience in review of aircraft lightning damage indicates the importance of full vehicle testing for any real confidence in system operation under the strong field electromagnetic environment and this especially applies to coordination of EMP and lightning protection. (auth)

11437 (PEM-31) NUCLEAR EMP: EMP TRANSIENT SUPPRESSION. Clark, O. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1974. 25p. Dep. NTIS $4.25.

TransZorbs[T.M.] have been proven to be effective in suppressing fast rise-times, EMP type transients. Small in size, having subnanosecond response times, and with current handling capabilities at levels of more than 500 amperes, TransZorb silicon devices have been found to be suitable in many transient protection applications. This note describes what TransZorbs are, how they work, and how to employ them for EMP protection. Results of pulse testing are given, along with a description of capacitance effects and means to reduce these effects. Various hybrid schemes, in which TransZorbs are used in conjunction with other types of protective devices, are also discussed. (auth)

11438 (PEM-32) NUCLEAR EMP: PEAK CURRENT ESTIMATES: CYLINDERS IN FREE SPACE WITH EXTENSIONS TO OTHER STRUCTURES. Landt, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1974. 24p. Dep. NTIS $4.25.

A method has been developed to estimate both the transient response of straight wire scatterers and the peak current induced on a straight wire. Extensions of the method include the effects of loading and the treatment of more complex structures. A sample work sheet and the necessary response curves are provided for peak current estimates. Accuracies on the order of 10% can be obtained, as demonstrated by several examples. (auth)

11439 (PEM-36) NUCLEAR EMP: TECHNIQUES TO DETERMINE SUBSYSTEM LEVEL ELECTROMAGNETIC PULSE SUSCEPTIBILITY. Lunn, T. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1974. 22p. Dep. NTIS $4.25.

Test techniques, analysis and simulation hardware which may be used to assess subsystem susceptibility to EMP are described and their limitations discussed. An investigation of the susceptibility of a missile autopilot demonstrated that standard circuit analysis techniques can become inadequate when applied to high frequency EMP transients. Field coupling can become more important than conduction, and burnout can occur in "buried" as opposed to interface circuits. Therefore, an alternate semi-empirical method for analyzing burnout susceptibility has been devised and is described. Additional topics include: analysis and investigative testing to increase susceptibility confidence levels, high frequency coupling models, high level cable drive equipment, and techniques for upset and burnout testing on functioning units. (auth)

11440 (PEM-42) NUCLEAR EMP: HYBRID SPARK GAP SURGE ARRESTERS: A HIGH FREQUENCY RECEIVE SYSTEM ARRESTER FOR LIGHTNING AND EMP PROTECTION. Malone, E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. 26p. Dep. NTIS $4.50.

Recently with the shift from basically transient hard equipment input stages to solid state designs more susceptible to damage

from low level transients, and with the increased awareness of the EMP threat, a search for more efficient surge protection devices has taken place. This note discusses one hybrid, two stage spark gap design which provides lightning protection, with a heavy-duty spark gap followed by a faster light-duty spark gap for EMP protection. Several alternative hybrid designs are discussed, which combine spark gaps with other devices for specific application problems. (auth)

11441 PROTECT AGAINST NUCLEAR TRANSIENTS. Paolantonio, A. N. Electron. Des.; 22: No. 4, 64F; 64G; 64H; 64I; 64J(15 Feb 1974).

The use of the symmetrical T network, with two resistors and one capacitor, for protecting digital circuits against transient radiation effects is described. The design procedure for the network parameters is outlined, and a sample problem is given. (WKH)

11442 MICROWAVE SEMICONDUCTOR DEVICES: FUNDAMENTALS AND RADIATION EFFECTS. Chaffin, R. J. New York; John Wiley and Sons, Inc. (1973). 395p. $22.50.

The characteristic properties of bulk semiconductors are examined, giving attention to the crystalline state, motions of electrons in a crystal, intrinsic and extrinsic carrier densities, mobility and conductivity, diffusion and recombination, and the continuity equation. Junction diodes and transistors are discussed along with device fabrication and parameter measurement techniques, the basic radiation damage to semiconductors, Schottky-barrier diode mixers and detectors, radiation damage in p-i-n switches and limiters, and radiation damage in IMPATT and TRAPATT devices. Other subjects considered are related to radiation damage in Gunn and LSA devices, BARITT devices, microwave transistors, and tunnel diode devices. (IAA)

11443 LITHIUM SALT CRYSTALS PRESENTING AN EXCELLENT RESISTANCE UNDER A NEUTRON FLUX. Bret, A. (to Commissariat a l'Energie Nuclear). French Patent 2,173,645/A/. 13 Jan 1972. 5p. (In French).

These piezoelectric materials which can be used as transducers operating under a neutron beam are formed of crystals of lithium salts of the group comprising lithium niobate and lithium tantalate in which the lithium has an isotopic content of lithium 7 higher than its natural lithium content and preferably higher than 99%. (FR)

11444 SELECTIVE LOW LEVEL IRRADIATION TO IMPROVE BLOCKING VOLTAGE YIELD OF JUNCTIONED SEMICONDUCTORS. Roberts, J. S.; Cresswell, M. W. (to Westinghouse Electric Corp.). US Patent 3,852,612. 3 Dec 1974. Priority date 10 Aug 1973, Belgium. 6p.

The blocking voltage capability of PN junctioned semiconductor devices selected from transistors and thyristors is increased, while maintaining the forward voltage drop capability, by selectively irradiating with low level irradiation corresponding to an exposure of less than 1×10^{13} electrons/cm^2 with 2 MeV electron radiation. The devices are preferably irradiated with electron radiation of an intensity greater than 1 MeV and most desirably 2 MeV to an electron exposure below 1×10^{13} electrons/cm^2. (Official Gazette)

11445 SELECTIVE IRRADIATION OF GATED SEMICONDUCTOR DEVICES TO CONTROL GATE SENSITIVITY. Roberts, J. S.; Cresswell, M. W. (to Westinghouse Electric Corp.). US Patent 3,840,887. 8 Oct 1974. Filed date 25 Aug 1972. 10p.

By selective irradiation, the gate sensitivity of gated semiconductor devices such as thyristors and transistors is controlled without changing certain other electrical characteristics of the device. Decreased gate sensitivity is achieved without corresponding increases in forward voltage drop by masking conducting portions of the device against radiation, such as electron radiation, and irradiating gating portions of the device with suitable radiation such as electron radiation. Further, gate sensitivity can be maintained while reducing turn-off times and/or increasing blocking voltages by masking gating portions of the device against radiation such as electron radiation, and irradiating conducting portions and/or peripheral portions of the device with suitable radiation such as electron radiation. (Official Gazette)

Miscellaneous Instruments

Refer also to abstracts 11277, 11760, 12789, 13232, 13235, 13260, 13316, and 13397.

11446 (BARC-725) ANNUAL REPORT OF TEST EQUIPMENT AND DISPLAY SYSTEMS, SECTION ELECTRONICS DIVISION, 1972. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 32p. Dep. NTIS (US Sales Only) $4.75.

The activities of the Test Equipment and Display Systems Section of Electronics Division are briefly discussed under the categories: (a) test equipment for the measurement, calibration and standardization of the electronic equipment both for nuclear and non-nuclear applications; (b) display system for BARC, industry, and medicine; (c) medical electronics; (d) instrumentation for the analysis and monitoring of bio-electric potentials; and (e) instrumentation systems for other agencies on request, e.g., automatic warning system for railways etc. (WHK)

11447 (FEI-364) DYNAMIC CHARACTERISTICS OF THERMOCOUPLES. Sorokin, D. N.; Dzhusov, Yu. P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1973. 30p. (In Russian). INIS.

Basic questions of thermal inertia as applied to thermocouples for measuring temperatures in liquid and gaseous media are examined. Experimental data on the inertia of thermocouples are reported and analyzed. (tr-auth)

11448 (IAE-2342) STRUCTURAL ASSEMBLIES FOR CIRCUITS OF NUCLEAR ELECTRONICS. Apalin, V. F.; Afonin, A. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 28p. (In Russian). INIS.

A system of functional units which resolves most of the problems of nuclear electronics in the microsecond region, with the exception of high resolution spectrometry, is described. The system includes signal amplifiers from nuclear detectors, linear delay and forming circuits, installations for amplitude and time selection, and different forming circuits. In all 16 different circuits, developed in consideration of the specifications of the device for registering nuclear radiation and constructed with "element II"-type functional units of wide applicability, are proposed. The subassemblies do not require individual alignment and sharply reduce the length of time needed for the fabrication of experimental installations. (tr-auth)

11449 (IFA-FN-47-1974) MOVING CRYSTAL NEUTRON MONOCHROMATOR. Bally, D.; Tarina, E.; Popa, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

A moving crystal neutron monochromator, producing pure monochromatic neutron beams (the higher reflection orders are eliminated) and operating in the transmission arrangement, is described. The resolution of this monochromator as a function of the horizontal and vertical divergence of the incoming and reflected neutron beams and of the Doppler effect gradient is calculated. Experimental data illustrating the resolution, the luminosity and the efficiency for neutron scattering experiments are reported. (auth)

11450 (INIS-mf-1517) NOVA INTERFACE RACK PHA INTERFACE. Harvey, G. A.; Tresling, J. D. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). 31 Jan 1974. 30p. INIS.

The Nova Interface Rack–Pulse Height Analyzer Interface EL 377/2D1/ is for interfacing general purpose pulse height analyzers (PHA) and/or analog-to-digital converters (ADC) to the Nova line of minicomputers by means of the Nova Interface Rack (NIR). By means of option 01, the unit can be extended to a bi-parametric system. A double buffering technique is used to transfer data, thereby enabling the converter to run at maximum speed. Two methods are available for entering the PHA data into the computer: First, by means of interrupting the computer and a programmed data entry; secondly, by the use of the direct memory increment (DMI) facility of the Nova computer. In this second mode the interface only interrupts the computer on a channel overflow. The interface is equipped with a base register to which the channel address is added so that the spectrum can be loaded into any part of memory. (INIS)

11451 (INR-1431/8/E) SCALE EXPANDER AND A CURRENT STABILIZER IN A SET FOR ABSORPTION SPECTROSCOPY. Hammer, W.; Otrebski, J. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 11p. INIS.

In atomic absorption spectroscopy of trace amounts of elements the deflection of a meter can be quite small of the order of 0.5 to 2.5% (full deflection of the meter corresponds to emission without absorption). The purpose of the expander described below is amplification of the signal with regard to the potential corresponding to full deflection of the meter. The conversion factor of the scale expansion in the range from 1x to 100 can be changed stepwise by changing feedback (the multiplier can be increased to 200x). The linearity of the expander at an amplification of 100x is about 0.1%. In atomic absorption spectroscopy a hollow cathode lamp is used as a light source. This lamp should be supplied with stabilized

current. The described stabilizer is controlled stepwise in the range 3 to 30 mA, of a maximum output voltage of 800 V and a stability of about 1%. (auth)

11452 (JINR-10-7939) SPIRAL READER. General Description and the Results of Precision Characteristic Measurements. Kotov, V. M.; Bulanova, G. N.; Vasil'ev, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1974. 27p. (In Russian). INIS.

The spiral reader scanning system, designed to process bubble chamber photographs, is described. The characteristics of the basic units of the spiral reader are briefly given. The operation of all reading systems is done under computer control. A brief description is given of the structure of the control and filtration program. The precision characteristics of the spiral reader are reported. (tr-auth)

11453 (JINR-13-7770) ADJUSTING COUNTER IN THE CAMAC SYSTEM. Urmanova, L. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. (In Russian). INIS.

The adjusting counter consists of 8 decades working by subtraction. When the number of input pulse counts from the external generator reaches an established number, output pulses appear at the output of the unit. A preliminary setting of the number can be done by a manual method with a digital switch on the front panel of the unit and automatically by CAMAC orders. Indications of the number are given in the form of floating decimals using three displays on the front panel. Two of these displays are used for indicating the two primary classes of the number and the third for indicating the exponent. The width of the unit is 51.3 mm. (tr-auth)

11454 MASS SPECTRA ANALYSIS. Franses, J. J. (to Instem Ltd.). British Patent 1,363,144. 14 Aug 1974. Filed date 13 Jul 1971. 5p.

Improved apparatus and methods for processing the output data from a mass spectrometer into a form suitable either for direct input to a computer or for operating a paper tape punch or other recording device are described. The analyzer comprises a main data channel for producing main data signals in digital word format representing the intensities and times of the peaks in a spectral scan signal, together with a subsidiary channel for carrying signals representing subsidiary spectrometer data in digital word format. Control means are provided for sampling the subsidiary data and passing it into the main channel. The main and subsidiary data are identified by status bits included in the digital word format of the analyzer output. A number of subsidiary channels may be employed and the analyzer may include a multiplexer by which sampled data are multiplexed into the main channel, one subsidiary channel may include a mass marker unit giving a logic signal at predetermined mass unit intervals, and another may be connected to a total ion current monitor. The mass marker unit channel may be connected to the control means and the total ion current channel may be connected to the multiplexer through which the main data signals are also fed. A selector switch may be associated with the control means to enable the total ion current to be sampled at different time intervals. (UK)

11455 THERMOGRAPH (TEMPERATURE RECORDER) (13 JUN 1974)(ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-2399). 31 drawings.

11456 MAGNETIC TEMPERATURE SENSOR. Dial, R. E.; Keyes, J. J. Jr.; Krewson, J. W. Jr. (to United States Atomic Energy Commission). US Patent 3,848,466. 19 Nov 1974. Filed date 30 Jan 1974. 6p.

A sensor for determining rapid temperature changes at the surface of nonmagnetic structures is described. A thin layer of a material of sufficiently high magnetic permeability and Curie temperature is bonded to the surface to be monitored and a magnetic field is induced in the layer. A sensing coil detects changes in the permeability of the magnetic material layer via changes in impedance and/or phase shift as a function of the layer temperature. The sensor was specifically developed for the LMFBR program for measuring fuel rod temperatures immersed in liquid sodium coolant, but it also has other applications. (Official Gazette)

11457 APPLICATION OF RADIOISOTOPE-INDUCED ENERGY DISPERSIVE ROENTGEN EMISSION ANALYSIS (REA). Kis-Varga, M.; Basco, J. (MTA Atommagkutato Intezete, Debrecen, Hungary). Izotoptechnika; 17: No. 9-10, 453-457 (1974). (In Hungarian).

The development and testing of Si(Li) x-ray spectrometers for x-ray fluorescence analysis are described. (WHK)

11458 TECHNOLOGY AND USE OF W-Re THERMOCOUPLES. Schley, R.; Matteudi, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). High Temp.-High Pressures; 5: No. 1, 111-120(1973). (In French).

From 3rd European conference on thermophysical properties; Turin, Italy (20 Jun 1972).

Different ways of making W-Re thermocouples are described. The difficulties encountered are outlined, and in order to solve them the individual components (the wires, insulation, sheaths), assembly operations, and methods of making the hot junctions are examined. Some conclusions are given with regard to drawing up suitable specifications. Finally, a few applications of W-Re alloy thermocouples in nuclear and other fields are outlined. Although many problems remain to be solved to ensure their adequate reliability, these thermocouples have in recent years been widely used for measuring temperatures in the range 1200 to 2200°C. (auth)

11459 DETECTION OF ELEMENTS BY IRRADIATING MATERIAL AND MEASURING SCATTERED RADIATION AT TWO ENERGY LEVELS. Barton, H. M. Jr.; Gray, P. R. (to Phillips Petroleum Co.). US Patent 3,843,881. 22 Oct 1974. Filed date 11 Jan 1973. 4p.

Metals and other elements are detected in a material by irradiating the material with high energy radiation; scattered radiation from the material is measured by two pulse height analyzers set at two different energy levels in the region of Compton scattering. The ratio of the measured radiation at the two energy levels is indicative of the presence of the elements. (Official Gazette)

11460 X-RAY MICROANALYZER PROBE. Goganov, D. A.; Zhizhin, I. P.; Komyak, N. I.; Leiderman, M. S.; Luk'yanchenko, E. M. App. Metody Rentgenovskogo Anal.; No. 13, 186-193(1974). (In Russian).

An x ray electron-probe microanalyzer "Probe" is described, and its technical characteristics are presented. The basic characteristics are: an electron probe diameter of 1 to 2 μm, accelerating voltage of 8 to 50 kV, wavelength range from 0.8 to 113 Å, elements to be detected from Be to uranium, sensitivity for copper of 0.02%, reproduction accuracy of 1%, image magnification from 150 to 1500 times, three spectrometric channels, and a maximum sample size of 50 × 50 mm. (SJR)

11461 AUTOMATIC DISCRETE ROENTGENORADIOMETRIC ANALYSER OF DRY SAMPLES BY USING THE K-ABSORPTION EDGE. Abdulin, S. F.; Nagarev, S. V.; Shkaruba, V. N.; Lukashevskii, V. V. App. Metody Rentgenovskogo Anal.; No. 13, 97-102(1974). (In Russian).

In analyzing homogeneous products at a constant sample layer thickness the metal content of the sample can be determined from the count rates at radiation energies above and below the K-absorption edge before passage of the radiation through the sample and after passage of the radiation through the sample. Radiation (84 keV gamma) from a ^{170}Tm source strikes the surface of a target. Characteristic radiation from the target passes through the sample cuvette to a scintillation counter. On command the sample and target are interchanged, and counts are recorded again. In Ta determinations of mineral concentrates (0.2 to 2.0% Ta) the relative error was found to be <15%. The analysis time is 5 min. (SJR)

11462 NEUTRONOGRAPHIC UNIT OF HIGH RESOLUTION WITH A VARIABLE WAVELENGTH. Datt, I. D.; Ozerov, R. P.; Rannev, N. V. App. Metody Rentgenovskogo Anal.; No. 13, 16-19(1974). (In Russian).

A new variant has been constructed whose distinguishing feature is a large angle of monochromatization ($\theta_B \approx 45°$). Reactor neutrons are collimated and are sent to a crystal monochromator consisting of single crystal copper. Neutrons reflected from the monochromator at an angle of 90° pass through a second collimator, and strike the sample mounted in the goniometric head of a diffractometer. By means of a special goniometric unit it is possible to cover the range of wavelengths from 0.88 to 1.28 Å (reflections (442), (440), (224), (331), (004)). A second crystal-monochromator of single crystal Pb is used for structural studies at small angles of monochromatization. The monochromatic neutron flux is ~10 neutrons/min cm^2. The effectiveness of using this unit was estimated in measuring reflections from a NaCl crystal. (SJR)

11463 TRANSFER CHARACTERISTICS OF PEAK HEIGHT TYPE MAGNETIC AMPLIFIER. Ara, K.; Kawaguchi, C. (Japan Atomic Energy Research Inst., Tokai). Denki Gakkai Ronbunshi, C; 93: No. 3, 56-63(Mar 1973). (In Japanese).

Peak height type magnetic amplifiers have been developed as

the dc amplifier for the safety and protection instrumentation of nuclear reactors. Transmission characteristics of this type of magnetic amplifiers were analyzed by dealing with its behavior as an "impulse/amplitude modulator" having a hold circuit. A block diagram of the system was obtained by analyzing and simplifying input and output circuits. Generalized equations giving the transmission characteristics were derived by assuming a function which corresponds to the envelope of output signal pulse train, and the sampler output and Z-transformation of output voltage and current were determined. Frequency- and dc-characteristics and indicial response were examined and compared with experimental results. The experimental results for the frequency characteristics and the indicial response were in good agreement with the derived equation, but those for the dc characteristics show that internal feedback effect must not be neglected. (JA)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstract 12146.

11464 (CONF-741043-2) CALUTRON AS A SOURCE OF TARGET MATERIALS. Love, L. O. (Oak Ridge National Lab., Tenn. (USA)). 1974. 13p. Dep. NTIS $4.00.

From 3rd annual conference on the nuclear target development society; Chalk River, Ontario, Canada (1 Oct 1974).

The history, operation, and status of the ORNL calutron facility (including the 180° sector called ORSIS) are described. Some of the isotopes separated are tabulated, and shipments of separated stable isotopes from 1946 to 1973 are shown graphically. (WHK)

11465 (K-1868) EXPERIMENTAL DETERMINATION OF THE LOSS COEFFICIENT IN AN ANNULAR DIFFUSER. Angelelli, T. A. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 16 Dec 1974. Contract W-7405-eng-26. 80p. Dep. NTIS $5.45.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

There is a need for the experimental determination of the total pressure loss coefficient in an annular diffuser. Consequently, this investigation was undertaken to determine the relationship between the loss coefficient and other annular diffuser performance parameters, such as inlet boundary layer blockage, nondimensional length, and inlet Mach and Reynolds numbers. Also, the static pressure recovery as it relates to these parameters was studied. The annular diffuser configuration tested consisted of a zero angle, circular cylinder outer wall and a tapering cone centerbody. Diffusers with an area ratio of 2.79 and nondimensional lengths of 12 and 15 were tested at blockage levels varying from 4 to 9% over an inlet Mach number range of 0.24 to 0.46 and a Reynolds number variation of 0.28×10^6 to 0.46×10^6. In addition, the sharp inlet taper of the centerbody for the diffuser with nondimensional length of 12 was rounded to a more gradual taper and tested. Results indicated that varying the nondimensional length significantly altered the loss coefficient. For the nondimensional length of 12, the loss coefficient was 0.300 at a 4% inlet blockage level and 0.316 at an 8% level; for the nondimensional length of 15, values of 0.214 at a 6% blockage level and 0.226 at a 9% level resulted. Inlet blockage effects remained distinct in the incompressible flow range, but results tended toward convergence in the compressible range where the variation of loss coefficient with both Mach and Reynolds numbers was nonlinear. Also, it was determined that rounding the sharp inlet taper to a more gradual one produced as much reduction in loss coefficient as adding 25% to the diffuser's axial length. The static pressure recovery coefficient exhibited gains with the extended diffuser and the gradual inlet taper comparable to those of the loss coefficient and varied similarly with inlet blockage and Mach number levels. (auth)

11466 (MLM-2188(OP)) SEPARATION OF SULFUR ISOTOPES BY LIQUID THERMAL DIFFUSION AND BY CHEMICAL EXCHANGE. Rutherford, W. M.; Roos, W. J. (Mound Lab., Miamisburg, Ohio (USA)). 1974. Contract AT-33-1-GEN-53. 7p. (CONF-741120-3; SM-191/14). Dep. NTIS $4.00.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

The application of separated sulfur isotopes as environmental tracers depends upon their cost. Sulfur isotopes can be separated in quantities of several kilograms per year by liquid thermal diffusion and by the SO_2-bisulfite chemical exchange process. Mound Laboratory is developing both of these processes. Some of the basic problems associated with liquid thermal diffusion have been solved, and an experimental cascade using carbon disulfide as the working fluid is now being used to separate small quantities of material enriched to greater than 45% sulfur-34. Chemical exchange appears to be a better method of separating sulfur-34. A 5 column chemical exchange cascade using the bisulfite process is now being constructed. The chemical exchange system will be capable of producing 1.2 kg/yr of sulfur at an enrichment of 90% sulfur-34. Because of the anticipated cost of sulfur isotopes, applications will be limited to small amounts of enriched material. Double tagging of selected compounds may increase the range of usefulness. (auth)

11467 (REG/G-3.25(12-74)) STANDARD FORMAT AND CONTENT OF SAFETY ANALYSIS REPORTS FOR URANIUM ENRICHMENT FACILITIES. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Dec 1974. 67p. DRS Free.

The general requirements for uranium enrichment and other facility license applications are contained in 10 CFR Part 50. A proposed Part 52 currently in preparation would contain requirements specifically for license applications for uranium enrichment plants. The regulation would specify in general terms the information to be supplied in the Safety Analysis Reports (SARs) that must be submitted with an application. This document indicates the level of detail needed in the review of applications and suggests a standard format for its presentation. (TFD)

11468 URANIUM ENRICHED BY LASER. Gruhier, F. Sci. Avenir; No. 328, 566-571(Jun 1974). (In French).

The principles of photochemical separation of isotopes, particularly ^{235}U and ^{238}U are given. The difficulties of the process (selective excitation of an isotope; capture of excited atoms, etc.) are explained. The research effected in the world with a view to carrying out this process is presented and particular mention is made of the patent filed by Israel an a new uranium enrichment technique using a laser. (FR)

11469 STEELS FOR CANADIAN HEAVY WATER PLANTS. Langford, W. J. (Atomic Energy of Canada, Ltd., Ont.). Eng. Dig. (Toronto); 20: No. 8, 35-37(Sep 1974).

The choice of steel for Canadian heavy water plants is influenced by design philosophy, fabrication requirements, service conditions and jurisdictional rulings. However, some basic principles can be laid down. These principles have been incorporated into specifications which provide safety and operational reliability with economy. (auth)

11470 GETTING A HANDLE ON GAS ABSORPTION. Can. Chem. Process.; 58: No. 10, 19-21(Oct 1974).

The increasing demand for heavy water to meet Canada's domestic and export needs has spurred research to improve the GS process. Modifications to existing plants have resulted in a marked gain in heavy water production. AECL is also looking into several new methods for heavy water extraction. Among these are the hydrogen/amine and the hydrogen/water processes. (CA)

Isotopic Power Sources

Refer also to abstracts 11677 and 11875.

11471 (AD-746549) SMALL-SIZED SOURCES OF CURRENT. Orlov, V. A. Apr 1972. Translation of Malogabaritnye Istochniki Toka, Moscow, 1970. (FSTC-HT-23-228-72). 193p. NTIS.

The book describes transformers of various types of energy into electric energy. Principles of action, mechanism, technical and operational characteristics of modern sources of current (chemical, semiconductor, atomic, and others) are presented. (auth)

11472 (CEA-CONF-2588) EMERGENCY MEASURES AT THE INTERIOR AND EXTERIOR OF INSTALLATIONS IN THE CASE OF ACCIDENT. Hamard, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). [nd]. 29p. (In French). (CONF-731127-3). Dep. NTIS (US Sales Only) $4.50.

From meeting on radiological and environmental protection; Lima, Peru (19 Nov 1973).

The type and seriousness of nuclear accidents depends on the type of installation and the activities developed in it. The principal types of possible accidents include overheating of reactor fuels, mechanical explosions in hot laboratories and processing plants, power excursions, loss of a radiation source, rupture of a container of radioactive materials, fire, and accidents caused by natural or unforeseen phenomena. Each of these is briefly described. The dangers resulting at the interior and the exterior of a nuclear installation as a result of one of these types of accidents are outlined. The emergency measures to be taken inside the installation and outside it are described in some detail. (JSR)

Radiation Sources

Refer also to abstracts 11322 and 11548.

11473 (MLM-2127(J)) DESTRUCTIVE ANALYSIS OF NEUTRON SOURCES M-71 AND 1053S. Breakall, K. L. (Mound Lab., Miamisburg, Ohio (USA)). 6 Apr 1972. Contract AT-33-1-GEN-53. 26p. Dep. NTIS $4.50.

The results obtained from the destructive analysis of neutron sources M-71 and 1053S indicate gross reactions taking place between the $PuBe_{13}$ fuel form and the tantalum inner container.

Evidence of high pressures was observed in the porosity of the fuel and the cracking of weld zones of both the inner and outer containers. A partial correlation of the radiographic data with the destructive analyses was realized. The use of NDT analyses could be important on future investigations of neutron sources. (auth)

11474 (PF-4-73) INCREASING OF THE BEAM DENSITY BY MEANS OF A BEAM-PLASMA DISCHARGE IN AN ELECTRON GUN WITH MAGNETRON INJECTION. Sinman, S. (Ankara Nuklear Arastirma Merkezi (Turkey)). Nov 1973. 10p. (In Turkish). INIS.

11475 PRACTICAL APPLICATION OF THE NATIONAL (ITALIAN) LEGISLATION IN THE MANAGEMENT AND CONTROL OF RADIOACTIVE SUBSTANCES. Caldirola, P. (Univ., Milan); Montesanti, M. I. Energ. Nucl. (Milan); 21: No. 12, 685-692(Dec 1974). (In Italian).

This paper shows how it has been possible, on the ground of the general technical normative system described in a previous paper (see E. N., 21, 10, 559)—allowing the rules deriving from the national legislation on the management and control of radioisotopes to be put into effect, and to establish, by the aid of a computer, a computing system suitable to evaluate the various parameters characterizing the different managing operations and the relevant control coefficients. This system, elaborated for use in medical and biological activities of the University in Rome, is applicable also to other various activities (industrial agricultural, etc.) involving the utilization of radioisotopes. (auth)

11476 MEASUREMENTS OF PRIMARY SPECTRA FROM A KILOCURIE ^{60}Co UNIT AND A 6-MeV LINEAR ACCELERATOR. Jessen, K. A. (Umea Univ., Sweden). Acta Radiol., Ther., Phys., Biol.; 12: No. 6, 561-568(1974).

Measurements have been made of a kilocurie cobalt 60 unit and a 6 MeV linear accelerator with a NaI crystal spectrometer. Spreading of the primary radiation by Al foil and an iterative procedure for unfolding the pulse height distribution were applied. The dose of the scattered part of the primary ^{60}Co radiation reaches 13 ± 2 per cent of the total. The accelerator spectrum is compared with a theoretical thin target curve for bremsstrahlung in the forward direction. (auth)

11477 SPECTRAL DISTRIBUTION FROM ^{60}Co THERAPY UNITS. Loefroth, P. O.; Westman, S.; Hettinger, G. Acta Radiol., Ther., Phys., Biol.; 12: No. 6, 552-560(1974).

The energy distribution of photons in beams of six different ^{60}Co therapy units has been investigated using a NaI(Tl)-scintillation spectrometer. Differences in photon energy distribution were demonstrated. Calculations on the different photon distributions show that the differences expressed in terms of measured exposure are so small that the photon radiation from a ^{60}Co therapy unit can be considered a good reference radiation for dosimetry with accelerator-produced electron and photon radiation for medical use. (auth)

11478 SAFETY PROCESS AND DEVICE FOR LIMITING IN TIME THE GLOBAL DURATION OF REAL USE OF AN APPARATUS WORKING DISCONTINUOUSLY. Ravinet, Y.; Gleizes, R. French Patent 2,168,957. 28 Jan 1972. 10p. (In French).

This device is comprised of: (a) a power-relay adapted to close an electric circuit for controlling and voltage feeding the emitter apparatus actuated by an on-off switch controlling said apparatus; (b) a level adapter for converting the feed-voltage to a train of time-shifted pulses, and (d) a selective unit pre-set to a threshold which corresponds to the admissible maximum duration of the apparatus operation so that any crossing of that threshold will trigger a second relay to switch of which opens the feed electric circuit. (FR)

Design and Fabrication

11479 (CEA-R-4621) DESCRIPTION OF A MONOCHROMATIC X-RAY GENERATOR. Application to X-Ray Detector Sensitivity Measurements as a Function of Energy Between 6 keV and 100 keV. Chollet, J. P.; Colin, J.; Gouin, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92—Montrouge (France)). Nov 1974. 34p. (In French). Dep. NTIS (US Sales Only) $4.75.

A calibrated monoenergetic photon generator for use in the 6 to 100 keV energy band is described. The photons are obtained by exciting the K fluorescence of fourteen elements in succession with the bremsstrahlung from an X generator anticathode. The thicknesses of the fluorescent targets and their associated filters have been optimized to give a very pure X_K radiation, which is measured with either a solid germanium detector or a sodium iodide scintillation detector. This generator is used to study the energy response of an x-ray detector equipped with an NE 104 plastic scintillator. All the results obtained are given. (auth)

11480 DEVICE FOR EXAMINING MATERIALS OR FOR SURGICAL TREATMENTS BY GAMMA RAY IRRADIATION. Sauerwein, K.; Goedecke, H. US Patent 3,843,891. 22 Oct 1974. Priority date 29 Jun 1971, F.R. Germany. 6p.

A device for examining materials or treating human or animal patients by local gamma ray irradiation is described. A capsule containing gamma ray emitting material is mounted in a shielding block. A flexible longitudinal, hollow, thrust-transmitting cable extends from a bore in said shielding block. A probe is mounted at the free end of the flexible cable. A flexible rod is longitudinally movably mounted in the flexible cable and carries the capsule at its free end for propelling and withdrawing the capsule through the cable. A material which becomes luminous when subjected to gamma ray irradiation is at least mounted on the device in the vicinity of the operative locations of the capsule. This material may also be mounted along the path of travel of the capsule, thereby illustrating the movement of the capsule. (Official Gazette)

11481 METHOD OF MANUFACTURE OF NUCLEAR RADIATION SOURCES. Drabkina, L. E.; Mazurek, J. V.; Myasoedov, D. N.; Prokhorov, V. P.; Kachalov, V. A.; Ziv, D. M.; Ziv, V. S. US Patent 3,844,833. 29 Oct 1974. Filed Date 15 Feb 1972. 4p.

A method of manufacturing a radioactive source is described. The method comprises applying a radioactive material onto a substrate, then heating the radioactive material and the substrate to form a radioactive layer applied to the substrate. In order to apply a metal oxide sealing layer onto the radioactive layer, the radioactive layer is heated and a film of a chloride of titanium, tin, zirconium, aluminum or chromium is applied onto the heated radioactive layer and the chloride metal film is hydrolyzed to form the oxide sealing layer. (Official Gazette)

11482 IRRADIATION FACILITIES FOR EXPOSURE STANDARDS OF COBALT-60 AND CESIUM-137 GAMMA-RAYS. Takebayashi, M.; Kakui, Y.; Tonoike, M.; Nishimoto, A. (Electrotechnical Lab., Tokyo). Denshi Gijutsu Sogo Kenkyusho Iho; 38: No. 1-2, 19-28(Jun 1974). (In Japanese).

A new system for irradiation with cobalt-60 and cesium-137 gamma-rays, which is high in the degree of reproducibility and labor saving, was designed and built. It is an improvement in medical radiotherapy equipment, and consists of a lead protective housing and a source wheel. Three different sources, e.g., 1, 20 and 500 Ci for cobalt-60, are mounted at each quadrant on the circumference of a lead wheel which turns the beam on and off. It covers various exposure rates ranging from about 10mR/h to 1,000R/h with additional effects due to the inverse-square law attenuation. An automatic control system was also developed for accurate and fast operation of the system. (auth)

Industrial Uses

Refer also to abstracts 10520, 10774, 11324, 11544—11546, 11549—11555, and 12930.

11483 (IAEA-159) EXPERIENCES IN RADIATION STERILIZATION OF MEDICAL PRODUCTS. Proceedings of a Working Group Meeting on the Revision of the International Atomic Energy Agency Recommended Code of Practice for the Radiation Sterilization of Medical Products, Risoe, Denmark, 5—9 June 1972. (International Atomic Energy Agency, Vienna (Austria)). 1972. 260p. (CONF-7206106-).

A separate abstract was prepared for each of the 26 papers presented at the conference. (RCK)

For abstracts of individual papers see: 11369, 11484—11496, and 11544—11555.

11484 (IAEA-159, pp 53-66) CONTROL OF THE MICROBIOLOGICAL EFFICIENCY OF RADIATION STERILIZATION PLANTS BY MEANS OF B. SPHAERICUS, STRAIN C_1A, STR. FAECIUM, STRAIN $A_2$1, AND COLI PHAGE T_1. Emborg, C. (Atomic Energy Commission Research Establishment, Risoe, Denmark); Christensen, E. A.; Kallings, L. O.; Eriksen, W. H.; Bjergbakke, E.; Holm, N. W. 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

In the Recommended Code of Practice for radiation sterilization of medical products issued by the International Atomic Energy Agency in 1967, it is suggested that the microbiological efficiency of radiation sterilization plants be tested by means of microbio-

logical reference standards on commissioning and whenever essential changes in the plants are introduced. In cooperation with IAEA, the Accelerator Department at Risö produces and distributes test pieces with Str. faecium, strain $A_2$1, and test pieces with endospores of B. sphaericus, strain C_1A. Upon request, the microbiological efficiency of radiation plants may be compared to that of the Risö sources. This department has now executed such comparison testings for six research facilities and ten industrial radiation sterilization plants. Test pieces with Coli Phage T_1, produced and evaluated at Statens Bakteriologiska Laboratorium, Stockholm, have been included in most of the testings. General trends in the testing results are discussed with special emphasis on aspects for the future use of this control system. (auth)

11485 (IAEA-159, pp 115-124) DESIGN AND DOSIMETRY OF COBALT-60 MEDICAL PRODUCTS STERILIZATION PLANTS TO ENSURE PROCESSING TO DESIRED DOSES. Chu, R. (Atomic Energy of Canada Limited, Ottawa). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The design features of the ^{60}Co medical products sterilization plants built by Atomic Energy of Canada Limited ensure that all products receive the desired sterilization dose. Dosimetry during the commissioning of the irradiation plants to determine the minimum and maximum dose is performed using the ceric sulfate dosimetry system. Dosimetry using injection-molded cylinders of red perspex provides information on the dose distribution within product packages. (auth)

11486 (IAEA-159, pp 125-135) DOSIMETRY PROCEDURES FOR RADIATION STERILIZATION OF MEDICAL AND BIOMEDICAL PRODUCTS. Holm, N. W.; Bjergbakke, E. (Danish Atomic Energy Commission, Risoe). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Process control procedures in general are discussed and the unique role of dosimetry in providing the radiation sterilization process with a physicochemical means of integrated process control is pointed out. On the basis of experiences obtained from the IAEA-sponsored efficiency performance testing of ten industrial irradiation plants and five research facilities, some sources of dosimetric errors are suggested and discussed. (auth)

11487 (IAEA-159, pp 137-141) FOUR YEARS OF PRACTICAL EXPERIENCE WITH RED PERSPEX 400- DOSIMETRY IN A COMMERCIAL COBALT-60 IRRADIATION PLANT. Peter, K. H. (Vereinigte Fabriken Elastischer Chirurgie-Instrumente und Weichgummiwaren, Rommelshausen, Ger.). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The operating experiences of the 225,000 Ci ^{60}Co Willy Ruesch Commercial Plant for radiation sterilization of single-use medical instruments and devices are described. Dosimetry monitoring was conducted using red perspex 400 from the AERE in Harwell and a master timer and other controls. The technical details of the irradiator and the conveyor systems are given. Dose distribution in a vertical plane through the irradiation units indicates two dose minima-one at the top of the upper box and one at the bottom of the lower box, respectively. This leads to the conclusion that ample safety is guaranteed for the delivery of a minimum irradiation dose even higher than the required 2.5 Megarads. The proposal for changing the sterilization dose depending on the presterilization contamination has been strongly opposed as impractical and superfluous. 2.5 Megarads has been considered as a safe sterilization dose. (auth)

11488 (IAEA-159, pp 145-151) EXPERIENCE DERIVED FROM THE OPERATION OF A LARGE COBALT-60 IRRADIATION PLANT. Frohnsdorff, R. S. M. (Gillette Research and Development Lab., Reading, Eng.). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The experiences in operating, quality control, and production in the 650,000 curie ^{60}Co-irradiation plant at Reading, U.K. are presented for the nine years of its commissioning. An estimated amount of more than 3,500,00 Wantage boxes containing some 1,000,000,000 individual medical devices have passed through the radiation sterilization plant. No evidence of unsterile products out of these large number of items has been reported from the consumers. Details have been provided on the irradiation plant, the carriers, routine dosimetric aspects and other control processes for sterilization of medical products. The day-to-day control of the facility is entirely based on physical conditions aimed at ensuring that correct amount of energy is applied in the most uniform manner. These are accomplished by the standardized control of product boxes, layout of the products within the containers, manual log, automatic recording of time of every plant movement, including changes in source position as well as periodic determination of source symmetry. Besides, the most important control factor represents the dosimetric control and is accomplished by the routine placing of two pairs of red perspex dosimeters in the low and high dose positions in the carriers respectively. Microbiology is not used in the routine control of the irradiation plant although a considerable microbiological control program is carried out for the routine monitoring of other production operations, including the presterilization counts of bacterial flora of the factory's manufacturing sites to maintain hygienic standards, as well as the detection of radiation resistant mutant microorganisms in the plant environment. (auth)

11489 (IAEA-159, pp 153-156) USE OF IAEA's RECOMMENDED CODE OF PRACTICE FOR RADIATION STERILIZATION OF MEDICAL PRODUCTS IN DENMARK. Juul, F.; Christensen, E. A.; Holm, N. W. (Atomic Energy Commission Research Establishment, Risoe, Denmark). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The development of the industrial scale applications of ionizing radiation for sterilization of medical products and devices in Denmark since 1959 are reviewed. Utilization has been made of the IAEA/WHO Recommended Code of Practice for radiation sterilization of medical products to assist in the formulation of the Danish National Standards and Rules regulating such products. Three commercial plants are currently operating for the radiation sterilization of medical products in Denmark. (auth)

11490 (IAEA-159, pp 157-161) USE AND CONTROL OF RADIATION STERILIZATION IN NORWAY, RELATED TO IAEA'S CODE OF PRACTICE. Lerche, C. (National Inst. of Public Health, Oslo). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Radiation sterilization of medical materials in Norway is discussed. The sterilization practices take into consideration the recommendations by the IAEA/WHO for good practices of radiation sterilization of medical products. The efficiency of the facility is controlled by the use of bacterial reference standards (Streptococcus faecium and Bacillus sphaericus) as well as by red perspex and Fricke dosimeters and other technical control measures. The Nordic Pharmacopoeia has set the standard of production hygiene and sterility whereby the desired outcome does not permit more than one living microorganism in one million units of finished sterilized products. Based upon this the Norwegian Health Authorities have recommended the same radiation dose level as minimum requirement as by the Danish and Swedish authorities. The radiation dose requirement also depends upon the presterilization bacterial count. Radiation sterilization of new sutures and medical products including pharmaceuticals present a rapidly increasing scope and the significance of revised and updated IAEA/WHO recommended code of practice has been discussed against this background. (auth)

11491 (IAEA-159, pp 163-164) STERILIZATION ACCORDING TO THE NORDIC PHARMACOPOEIA. Fystro, D. (National Inst. of Public Health, Oslo). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Conventional sterilization practices according to Nordic Pharmacopoeia are discussed. Radiation sterilization has been recognized and incorporated among the methods of sterilization of medical products. The role of IAEA/WHO Code of Practice has been recognized. Recommendations have been made for further improvement of this Code, particularly by the inclusion of raw materials and pharmaceutical products. (auth)

11492 (IAEA-159, pp 165-173) PROBLEMS REQUIRING SPECIAL ATTENTION IN THE RADIATION STERILIZATION OF MEDICAL PRODUCTS IN INDIA. Iya, V. K. (Bhabha Atomic Research Centre, Trombay, India). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Background information on the development in India of the technical expertise and experiences leading to the commissioning of the first commercial ^{60}Co-facility for sterilizing medical sutures and

materials is presented. The future scope for such applications of nuclear technology to help solve the health problems is reviewed. The climatic, hygienic, and socioeconomic factors of India, as the representative of many other developing Member States in the tropics, have been elaborated. It has been stressed that the IAEA/WHO Recommended Code of Practice should take these factors into consideration while attempting to promote an economically feasible and practical approach towards the broadening of the scope for medical radiation sterilization for the developing countries. (auth)

11493 (IAEA-159, pp 175-177) LEGISLATION IN THE NETHERLANDS. Bekker, J. H. (Rijksinstituut voor Volksgezondheit, Utrecht). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The experiences from the practice of radiation sterilization of medical products in Netherlands are discussed. The various legislation controlling the safe production of the radiation sterilized medical products as well as their applications in the human clinical practices have been elaborated. The microbiological and dosimetric monitoring of the efficiency of the irradiator is conducted on commissioning and at regular intervals by the responsible authorities in Public Health matters. The product's quality and sterility aspects are open to inspection for clearance by the public health authorities and the manufacturer is responsible for the product and packaging while the owner of the sterilization plant for the sterilization processes including appropriate dose. (auth)

11494 (IAEA-159, pp 193-205) CONSIDERATION OF THE INTERNATIONAL ATOMIC ENERGY AGENCY RECOMMENDED CODE OF PRACTICE FOR "RADIOSTERILIZATION OF MEDICAL PRODUCTS". Phillips, G. O. (Univ. of Salford, Eng.). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products: Risoe, Denmark (5 Jun 1972).

The recommendations for the revision of the IAEA/WHO Recommended Code of Practice for radiation sterilization of medical products were proposed. Detailed discussions were given on the aspects of minimum radiation dose, the dosimetry monitoring, microbiological sterility and quality control as well as the sharing of responsibilities by the manufacturer for the quality and sterility of the goods and the operator of the irradiator for the delivery of the prescribed sterilizing radiation dose accurately. The fact that radiation is among the methods for sterilization, the other instructions for products and the production hygiene should comply with the general code for good manufacturing practices existing in the various national pharmacopoeia. Those need not be repeated in the Code of Practice for Radiation Sterilization of Medical Products. (auth)

11495 (IAEA-159, pp 207-209) REVIEW OF DOSIMETRY ASPECTS OF IAEA's RECOMMENDED CODE OF PRACTICE FOR RADIOSTERILIZATION OF MEDICAL PRODUCTS. Holm, N. W. (Danish Atomic Energy Commission, Risoe). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The Dosimetry section of the IAEA/WHO Recommended Code of Practice for Radiosterilization of Medical Products has been reviewed for necessary revision. The dosimetry calibration and intercomparisons conducted primarily at the facilities at Wantage and Risoe have encountered with some difficulties in the standardization of the dosimetry practices as the different dosimetry systems specified in the Code of Practice and followed at the various industrial radiation facilities are not comparable. It is proposed that either more technical details of the suggested dosimetry systems should be included in the IAEA/WHO recommendations or the dosimetry section of the Code should be restricted only in presenting the general guidelines regarding the kind of data requested without specifying what dosimetry system should be followed. (auth)

11496 (IAEA-159, pp 251-252) RECOMMENDATIONS OF THE WORKING GROUP TO THE INTERNATIONAL ATOMIC ENERGY AGENCY FOR THE ACTIVITIES IN THE FIELD OF RADIATION STERILIZATION OF MEDICAL PRODUCTS. 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

A list of ten recommendations concerning meetings, training courses, code of practice, publications, quality control of drugs, definition of terms, packaging of materials, and other topics is presented. (HLW)

11497 (IAEA-R-941-F) EFFECT OF GAMMA-RADIATION ON COMPOSITION, INSECT CONTROL, AND SHELF-LIKE EXTENSION OF IRAQI DATES AT DIFFERENT STAGES OF DEVELOPMENT. Part of a Coordinated Program on Shelf-Life Extension of Fruits and Vegetables. Final Report for the Period 1 August 1970–31 August 1973. Auda, H. (International Atomic Energy Agency, Vienna (Austria)). Nov 1973. 57p. INIS.

Date fruits, at different stages of ripening, were irradiated with doses of 0 to 1 Mrad. Protein, amino acids, sugars, and carotenoids present in the samples were assessed. Furthermore, the pectin content of the fruits was determined. Investigations for the estimation of shelf-life of the treated dates, in addition to their sensory evaluation at periodic intervals, were also undertaken. Moreover, studies relating to establishment of disinfesting radiation doses for the various developmental stages of Cadra cautella and Oryzaephilus surinamensis were pursued. On the basis of data generated from these studies, it appeared that low-dose radiation treatment could be used effectively to curb insect disinfestation of dates thereby obviating the economic losses presently encountered. Additional benefits would include prolongation of the shelf-life of dates so that their distribution over longer periods could be facilitated. (INIS)

11498 (INIS-mf-1471) COMPOSITION CHANGES AND COOKING QUALITY OF IRRADIATED LEGUMES (WITH SPECIAL REFERENCE TO CAJANUS CAJAN). Nene, S. P. (Bhabha Atomic Research Centre, Bombay (India). Biochemistry and Food Technology Div.). Dec 1973. 95p. INIS.

Thesis.

The potential use of radiation processing for improving cooking quality of dry legumes (pulses), particularly red gram (Cajanus Cajan), was investigated. The physicochemical changes effected by gamma radiation in proteins, carbohydrates and lipids are also reported. Related literature on the importance of legumes in human nutrition and on quality changes brought about by different processing conditions is reviewed. Fabrication of a texturometer designed for measuring textural changes such as softening which occur during cooking of legumes is described. Radiosensitivity of red gram proteins was studied by determining the changes in distribution pattern according to molecular weights by gel filtration. In vitro enzymic digestibility of red gram proteins was determined. No appreciable changes in the fatty acid composition in red gram was observed. Thus, it is indicated that irradiation of red gram improves its cooking and textural qualities, digestibility and vitamin retention. (INIS)

11499 (INIS-mf-1512, pp 87-92) REPORT ON THE EFFECT OF GAMMA IRRADIATION ON THE MIMOSINE CONTENT OF IPIL–IPIL LEAF MEAL. Alejandrino, A. L.; Goze, C.; Balboa, B. (Philippine Atomic Energy Commission, Manila). 1973.

From proceedings of the eighth annual convention on science and sanity in food safety; Manila (27 Nov 1973).

This study was initiated to determine the feasibility of using gamma irradiation to effect a reduction to a safe level the mimosine in ipil–ipil (Leucaena leucocephla Lam. de Wit) leaf meal. Ipil–ipil has a high protein content, but the presence of mimosine, a toxic amino acid, has restricted to a great extent its liberal incorporation into animal rations. Leaf meal samples of ipil–ipil weighing less than 1 gram in small plastic bags were subjected to high level of cobalt-60 gamma irradiation, ranging from 1.5 to 6 megarads. A modification of the procedure of Hegarty, Court, and Thorne was used in the determination of mimosine in the irradiated and unirradiated leaf meal samples. The process consists of acid extraction, column and thin layer separation, followed by spectrophotometry. Mimosine was found to undergo some degradation at high levels of gamma irradiation, i.e., at the megarad range. A comparison of the results obtained with radiolysis of mimosine in aqueous systems showed the following order of radiosensitivity: mimosine solution (1 mg/ml in water) mimosine in 0.1 N Hcl (1 mg/ml) mimosine in dried leaf meal. The observed magnitude of this effect on mimosine in the leaf meal sample is about 16% decrease at 4 Mrads. The protein content was only slightly affected. (INIS)

11500 (INT-54/I) APPLICATION OF WANG 720C MINICOMPUTER FOR THE PROCESSING OF EXPERIMENTAL DATA IN THE RADIOTRACER IDENTIFICATION MEASUREMENTS. Petryka, L.; Plechta, J. (Institute of Nuclear Physics and Techniques, Krakow (Poland)). 1974. 38p. (In Polish). Dep. NTIS (U. S. Sales Only) $5.00.

Handling methods for experimental data obtained in radiotracer identification measurements as well as the corresponding programs for numerical calculations by means of WANG 720C minicomputer are presented. The algorithms for the calculation of the parameters of the dispersion and tank-in-series models are given based on the residence time distribution of the tracer. The recirculation effect has also been considered. (auth)

11501 INFLUENCE OF GAMMA RADIATION ON THE WHOLESOMENESS AND TECHNOLOGICAL PROPERTIES OF MAIZE STARCH. Saint-Lebe, L.; Berger, G.; Mucchielli, A. (CEN de Cadarache, Saint-Paul-lez-Durance, France). pp 51-60 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974). (In French).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

In most cases, irradiation of starch at a dose of 300 krad enables the desired hygienic qualities to be achieved without changing the other technological properties of the product. Among the induced modifications, the adjustable formation of hydrogen peroxide can be of immediate interest to technologists. (auth)

11502 COMPOSITIONAL AND QUALITY CHANGES IN SOME IRRADIATED FOODS. Sreenivasan, A. (Bhabha Atomic Research Centre, Bombay). pp 129-155 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

In gamma-irradiated wheat there is molecular degradation of starch and protein components which influences the rheological properties like gelatinization viscosity of starch, dough development and stability as well as elasticity of gluten. The baking quality of wheat that has been irradiated at disinfestation dose levels is improved, resulting in a product with increased loaf volume, soft and uniform cell structure and higher acceptability. Enrichment of wheat flour with soya flour beyond 5% adversely affects the rheological properties and breads made with such dough mixes are poor in quality. However, with irradiated wheat, there are no significant changes in bread quality up to 10% replacement with soya flour; this could be increased to 15% with the use of trace amounts of surfactants like soya lecithin. A combination of low-dose irradiation and mild heat successfully extends shelf-life of bread chapaties (unleavened, Indian bread) by controlling fungal spoilage. The efficacy of this combination of radiation and heat treatment has been confirmed from studies with fungi isolated from naturally infected, baked products. Irradiated red gram (Cajanus cajan) shows reduction in cooking time, improvement in texture and better retention of some of the B vitamins on cooking. Oligosaccharides, reported as flatulence factors in legumes, are decreased in irradiated cooked red gram. There is degradation of proteins due to irradiation and hence increased susceptibility to proteolytic action in vitro. Low-dose irradiation effectively delays ripening of bananas and mangoes, resulting in better texture of the fruits over longer periods. In mangoes, there is also improvement in external appearance on ripening, due to formation of anthocyanins. Flavor in mangoes is influenced by the ratio of palmitic to palmitoleic acid of the lipid fraction which is slightly influenced by irradiation. Sprout inhibition by irradiation augments flavor in carrots which is reflected in changes in the composition of the volatiles when examined by gas chromatographic-mass spectrometric methods of separation. In potatoes, syntheses of chlorophyll and solanin are inhibited when irradiated and stored at subroom temperatures. Post-harvest fungal decay in tropical fruits like figs, grapes and bananas, can be controlled by use of mild, moist heat and low-dose irradiation. Thermal treatment in the canning of fruits and vegetables can be considerably reduced by resorting to sterilization with combined heat and low-dose irradiation. Products so obtained have better texture and flavor with less loss of nutrients. (auth)

11503 EFFECTS OF IRRADIATION ON THE TECHNOLOGICAL AND HYGIENIC QUALITIES OF SEVERAL FOOD PRODUCTS. Kiss, I.; Farkas, J.; Ferenczi, S.; Kalman, B.; Beczner, J. (Central Food Research Inst., Budapest). pp 157-177 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

The juice yield of grapes may be increased by irradiation. This is achieved by changing the technological properties of grapes and increasing the permeability of the cell walls. Thus, the energy requirement of pressing may be reduced or, by using the same energy, more juice may be obtained. The chemical analysis and organoleptic evaluation of the wine fermented from radiation-treated grapes has shown that the application of doses above 0.8 Mrad is not desirable. According to results achieved by interpolation it was found that a 10 to 12% increase in juice yield may be obtained by radiation doses of 0.4 to 0.5 Mrad, which are considered optimal. In experiments where dried string beans, carrots, celery and parsley root were irradiated in an electron accelerator or in a ^{60}Co gamma radiation source it was found that the consistency obtained by cooking untreated samples for 10 min may be achieved by cooking for only 2 min if the samples have been previously irradiated with 1 to 3 Mrad. On the basis of the results of studies on weight increase during rehydration and on change of consistency it seems possible that the reduced cooking time requirement is due not so much to increased water absorption but rather to the effect of irradiation on structural polysaccharides, thus determining the consistency of vegetables. Radiation doses improving consistency did not cause undesirable changes of taste and color in dried root vegetables and string beans. When onions were irradiated the color of the product darkened with increasing radiation dose. In relation to ground paprika the protective effect of irradiation was manifested mostly under unfavorable storage conditions, whereas with adequate packaging material radiation reduces the cell count which remains at a low level. The seasonings used in the preparation of industrial meat products and certain canned goods are mostly highly contaminated and contain also a high proportion of heat-resistant cells (bacterial spores). The cell count of seasonings and additives can be very efficiently reduced with ionizing radiations. A radiation dose of about 0.3 Mrad seems sufficient to achieve pasteurization and after-treatment with 1.5 Mrad gives a practically sterile product. The spoilage percentage of pork liver paste prepared with irradiated additive mixture was not quite one-seventh of that prepared with untreated additives even when given a heat treatment of $F_0 = 1.47$ sterilization equivalent. From this one can conclude that by using radappertized additive mixture a heat treatment of $F_0 = 2.5$ equivalent would be sufficient to achieve sterility even with respect to Clostridium botulinum. This heat treatment is just above one-sixth of the treatment applied in industry. Such a substantial reduction in the heat requirement without changing the sanitary safety would result in a substantial improvement in the product, in a saving of energy and in an increase in production capacity. Experiences with combination treatment have shown that not quite one-tenth of the present industrial heat treatment was sufficient to achieve microbiological stability in samples irradiated with 500 krad. Meat products can safely be manufactured with a $F_0 = 2.5$ heat treatment which is about one-fourth of the treatment applied at present, when irradiated with 500 krad. The quality characteristics of the products are substantially improved and the energy requirement reduced. (auth)

11504 REGULATIONS FOR THE USE OF RADIOACTIVE SOURCES ON BOARD BORING PLATFORMS IN USE FOR BORING FOR PETROLEUM DEPOSITS IN INNER NORWEGIAN WATERS, NORWEGIAN TERRITORIAL WATERS AND THAT PART OF THE CONTINENTAL SHELF WHICH IS UNDER NORWEGIAN JURISDICTION. Norsk Lovtidend; No. 2, 273-277(1973). (In Norwegian).

These regulations cover the transport, storage and use of radioactive sources on boring platforms and ships in Norwegian territorial waters and the Norwegian sector of the continental shelf. A written permit must be obtained from the State Institute for Radiation Hygiene and is valid for four years. Initial, annual and 4-yearly inspections are prescribed. Transport shall normally be by boat in accordance with the IAEA "Regulations for the Safe Transport of Radioactive Materials" and in containers satisfying the IAEA's specifications. Storage is allowed only while a measurement program is being carried out, and the storage room arranged according to the International Maritime Dangerous Goods Code. Responsibilities and personnel requirements are defined. Requirements for personnel dosimetry, contamination control and measures in case of accidents are stated. Finally, conditions for revoking of permits, stopping activities and deviations from the regulations are given, together with definition of punishment by fines for breaking the regulations. (NO)

11505 IRRADIATOR FOR WATER PURIFICATION. Ellison, C. V. (to Water Purification Corp. of America). US Patent 3,836,781. 17 Sep 1974. Filed date 1 Aug 1972. 4p.

An irradiator for sterilizing fluids, particularly contaminated effluents such as sewage is described. A housing is provided with a plurality of tubular partitions defining a flow path for causing sewage and the like to flow, alternately, back and forth past a series of source tubes containing radioactive material whereby the sewage provides shield means surrounding the radioactive source and becomes sterilized as it passes into and out of the housing. (Official Gazette)

11506 PRESENT STATE, TASKS, AND PROSPECTS OF HUNGARIAN ISOTOPE APPLICATION. Foldiak, G. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 437-446(1974). (In Hungarian).

The use of isotopes in science and industry is satisfactory, however a lag in the food industry and routine therapy and a

shortage in nuclear equipment and instruments can be observed. A national philosophy of development is needed. (auth)

11507 DETERMINATION OF THE MOTION OF OIL FIELD DEEP WATERS WITH TRITIUM TRACING. Dallos, I. (Koolajes Foldgazbanyaszati Ipari Kutato Laboratorium, Budapest). Izotoptechnika; 17: No. 9-10, 489-492(1974). (In Hungarian).

A tritium tracing technique for measuring ground water movement in oil fields is described. The tritium is detected in the gaseous phase by an ionization chamber. (auth)

11508 CONTROL OF TECHNOLOGICAL DUST SOURCES BY RADIOACTIVE TRACING. Szy, D. (Semmelweis Orvostudomanyi Egyetem Radiologiai Klinikaja, Budapest). Izotoptechnika; 17: No. 9-10, 512-515(1974). (In Hungarian).

Preliminary studies on continuous measurement of dust content in the range of 5 to 10 mg/m^3 with an error of ±20% are reported. (auth)

11509 DETERMINATION OF THE ADSORPTION OF RADIOACTIVE TRACER ON OIL RESERVOIR ROCKS. Rona, V. (MTA Izotop Intezete, Budapest). Izotoptechnika; 17: No. 9-10, 504-511(1974). (In Hungarian).

A study of the adsorption of ^{22}Na ions on three rock samples is discussed. (auth)

11510 PHOTOGRAPHIC PRODUCTS AND PROCESSES COMPRISING SYNTHETIC NUCLEAR ISOTOPES. Gerber, A. M.; Walworth, V. K. (to Polaroid Corp.). US Patent 3,852,072. 3 Dec 1974. Filed date 11 May 1972. 6p.

Photosensitive silver halide emulsions having increased photographic sensitivity are prepared by incorporating therein a nuclear radiation source. (Official Gazette)

11511 EFFECT OF STERILIZING IRRADIATION DOSES ON PROPERTIES OF POLYMERS FOR MEDICAL USE. Postrigan', M. V.; Krivonosov, A. I.; Tikhomirova, N. S.; Apinis, A. P.; Kajmin', I. F.; Rajkhlin, L. B. Plast. Massy; No. 2, 24-26(1974). (In Russian).

For english translation see the journal Sov. Plast.

The effect of γ radiation at doses from 0 to 10 Mrad on some physical-chemical and physical-mechanical properties of polymers for medical use (PEVP, PENP, dacryl-4b, and type T-35 PVC) was examined. It was established that during irradiation at sterilizing doses of 2.5 Mrad definite physical-chemical processes occur. However the change in the physical-mechanical properties was insignificant. They were therefore recommended as construction materials for the fabrication of radiation-sterilized articles for medical purposes. (tr-auth)

11512 EFFECT OF IRRADIATION ON VOLATILE CONSTITUENTS OF STORED HADDOCK FLESH. Angelini, P. (Army Natick Labs., MA); Merritt, C. Jr.; Mendelsohn, J. M.; King, F. J. J. Food Sci.; 40: No. 1, 197-199(1975).

The effects of irradiation on the volatile constituents found in haddock flesh following storage have been studied. Fresh haddock fillets were irradiated in sealed mylar bags at doses of 0, 0.2, 2.8, and 5.6 Mrad. The volatile constituents were collected from the samples by low temperature-high vacuum distillation technique and analyzed by combined gas chromatograph/mass spectrometry. All lots of haddock were sampled before storage at 5.5°C. The nonirradiated samples were stored for 14 days and irradiated samples for 30 days. The results show a substantial increase in the amounts of volatile components for the nonirradiated stored samples. Sulfur compounds (especially methyl mercaptan, dimethyl sulfide, and dimethyl disulfide), carbonyl compounds and trimethylamine increased greatly on storage of nonirradiated haddock. Haddock samples irradiated at 0.2 Mrad also show an increase in amounts of volatiles on storage. The haddock samples irradiated at both 2.8 and 5.6 Mrad show smaller amounts of volatile components after 30 days of storage. Benzene and toluene, although minor constituents in all samples, were present in larger quantities in the irradiated samples. (auth)

11513 RADIATION SOURCE HOLDER. Reim, T. E.; Pollack, J. J.; Kemmerling, R. A. (to Republic Steel Corp.). US Patent 3,848,135. 12 Nov 1974. Filed Date 29 Oct 1970. 8p.

A radiation source holder is described. The holder has a wedge-shaped forward portion and a forwardly extending prow which serve to direct the granular material past and below the holder. (Official Gazette)

11514 RV-1200 IRRADIATION PLANT FOR VULCANIZATION OF TEMPERATURE-RESISTANT SELF-ADHESIVE INSULATING TAPE AND RUBBER-GLASS-CLOTH. Pekarskii, N. A.; Osipov, V. B.; Poddoubnii, I. J.; Levedeva, G. N.; Mamikonyan, S. V.; Terent'ev, B. M.; Aver'yanov, S. W.; Tshistov, J. D.; Goldin, V. A.; Safin, R. R.; Marfin, G. I. (Unionsforschungsinstitut fuer Strahlentechnik, Moscow). Isotopenpraxis; 10: No. 9, 345-348(Sep 1974). (In German).

For the industrial radiation vulcanization of insulating tape and rubber-glass cloth, a radiation source of about 500 kCi, a radiation chamber of large dimensions, and good biological shielding are required. The principal parameters and the construction of the RV-1200 irradiation facility for industrial vulcanization are described. A ^{60}Co source was used. (JSR)

LIFE SCIENCES

Radiation Effects on Biochemicals

Refer also to abstracts 10715, 10716, 10718, 10724, 10744, 10745, 10771, 10773, 11567, 11622, 13497, 13501, 13509, and 13510.

11515 INDUCTION OF SINGLE-STRAND BREAKS (ALKALI-LABILE BONDS) IN BACTERIAL AND PHAGE DNA BY NEAR UV (365 nm) RADIATION. Tyrrell, R. M.; Ley, R. D.; Webb, R. B. (Argonne National Lab., IL). Photochem. Photobiol.; 20: No. 5, 395-398(Nov 1974).

Irradiation at 365 nm resulted in the induction of approximately 2.4×10^{-6} and 1.2×10^{-6} single-strand breaks (alkali-labile bonds) per 10^8 daltons per J m^{-2} in extracted phage T4 DNA and in Escherichia coli bacterial DNA, respectively. The rate of break induction in DNA of intact phage was approximately one-fourth that for extracted phage DNA. 2-aminoethylisothiouronium bromide-HBr protected against break induction in both phage systems. No breaks were induced in the DNA of bacteria irradiated under anaerobic conditions over the dose range tested. Possible induction mechanisms are suggested. Consideration is given to the relative importance of pyrimidine dimers and single-strand breaks in the bactericidal action of 365 nm radiation. (auth)

11516 ULTRAVIOLET AND N-FORMYL-KYNURENINE-SENSITIZED PHOTOINACTIVATION OF BOVINE CARBONIC ANHYDRASE. An Internal Photodynamic Effect. Walrant, P.; Santus, R. (Museum National d'Histoire Naturelle, Paris). Photochem. Photobiol.; 20: No. 5, 455-460(Nov 1974).

Direct photoinactivation by uv light of bovine carbonic anhydrase, as well as its photosensitization by N-formyl-kynurenine, a tryptophan photooxidation product, has been investigated. In the presence of oxygen both methods led to similar results: the enzyme lost its activity, the tryptophanyl, histidyl and, to a lesser extent, tyrosyl residues having been destroyed. In nitrogen-saturated solutions, a dramatic drop was observed in the photoinactiation yield under the direct action of ultraviolet light, whereas histidyl residues remained intact. Evidence indicated an internal photodynamic action of N-formyl-kynurenine in the protein core produced by the uv photoinactivation of tryptophanyl residues. Photoinactivation of oxygenated enzyme solutions by external and internal photodynamic action correlated with histidyl residue destruction via singlet oxygen. The possible importance of the photodynamic ability of N-formyl-kynurenine in the photochemistry of proteins, DNA, and cells is discussed. (auth)

11517 INDANE-TRIONE INFLUENCE ON RADIATION DAMAGE TO BACTERIAL DNA AND ON ITS REPAIR. Sapora, O.; Simone, G.; Quintiliani, M. (Instituto Superiore di Sanita, Rome). Int. J. Radiat. Biol.; 26: No. 3, 297-303(Sep 1974).

The influence of indane trione (IT; 10^{-3}M) on the production and repair of single-strand breaks, and on DNA degradation, in aqueous suspensions of cells of Escherichia coli B/r irradiated with x rays in different gas phases was investigated, together with the relationships between the effects on DNA and those on cell-survival. The results showed that IT had the ability at the maximum sub-lethal concentration, to increase the anoxic lethality of E.coli B/r to a level corresponding to 60% of the oxic lethality, and to increase the amount of anoxic DNA breakage and degradiation to 100% of the oxic level. These results support the hypothesis that IT can mimic only one component of the oxygen-dependent lethal radiation damage and that this component accounts for the full oxygen effect on the production of DNA single strand breaks and DNA degradation. (UK)

11518 GENE FUNCTION AND STRAND BREAKS IN DNA OF γ-IRRADIATED T7 BACTERIOPHAGES. Coquerelle, T.; Bopp, E.; Hagen, U. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 26: No. 3, 219-226(Sep 1974).

The effect of γ irradiation on gene function in bacteriophage T7 was examined and compared with the alteration of the DNA structure. An early function tested was the synthesis of T7 specific RNA polymerase. Its relative radiosensitivity was 0.32 compared with the plaque-forming ability. The same relative sensitivity of 0.30 was observed for the inhibition of injection and for the formation of double-strand breaks. This observation confirmed the hypothesis that, after infection with γ-irradiated phage, only DNA molecules with an intact double helix are injected into the host cell. The radiosensitivity of the synthesis of lysozyme, tested as late function was 0.58 compared with plaque-forming ability. (auth)

11519 (STI/PUB-370) IMPROVEMENT OF FOOD QUALITY BY IRRADIATION. Panel Proceedings Series. Proceedings of a Panel Held in Vienna, Austria, June 18–22, 1973. (International Atomic Energy Agency, Vienna (Austria)). Aug 1974. 193p. (In French and English). (CONF-730684-). IAEA $9.00.

Separate abstracts were prepared for each of the 10 papers included: An abstract of an additional paper is included in the proceedings. The title of this abstract is "Changes in cell permeability due to irradiation: effect of ^{60}Co gamma rays on the phospholipase D enzyme." (ERB)

For abstracts of individual papers see: 10715–10718, 11501–11503, and 11520–11522.

11520 IRRADIATION OF FOOD AND FOOD CONSTITUENTS: CHEMICAL AND HYGIENIC CONSEQUENCES. Schubert, J. (Univ. of Pittsburgh). pp 1-38 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

A major objective of food irradiation is to optimize the hygienic and technological qualities while minimizing the radiation doses employed. In order to attain or approach these aims it is necessary to consider how the radiation chemical changes produced in food ingredients can be modified, minimized, or maximized. Compounds formed upon irradiation which are most likely to prove cytotoxic in vitro but rarely in vivo are those containing a conjugated double bond, especially α,β-unsaturated carbonyl compounds These are formed principally on irradiation of aqueous solutions of sugars and unsaturated fatty acids. Another group of cytotoxic agents arise from irradiation of certain amino acids and nucleic-acid bases when oxygen is present, resulting in the formation of adducts with radiolytic peroxides, e.g., histidine, which inhibit bacterial growth. In some cases, the effects of irradiation on food ingredients parallel those produced by non-irradiation processes. For example, α,β-unsaturated carbonyl compounds are produced by autoxidation of lipids independently of irradiation or by simply heating 2-deoxysugars in aqueous solution. Methods for enhancing the hygienic effects of certain foods while minimizing the irradiation doses employed are discussed. These are based on the use of selected, non-toxic scavenging agents which can be chosen so as to increase or decrease the levels of a given free radical such as OH or e^-_{aq}, depending on the objective sought. (auth)

11521 ASPECTS OF THE EFFECT OF IONIZING RADIATION ON ENZYMES. Sanner, T.; Kovacs-Proszt, G.; Witkowski, S. (Norwegian Radium Hospital, Oslo). pp 101-115 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

The yield of inactivation of enzymes irradiated in the dry state is nearly the same for most enzymes (G = 1-3). In contrast, the yield of inactivation in dilute aqueous solution varies by a factor of more than 100 and is, in general, considerably lower than the yield in the dry state. The relative role of the direct and indirect action when food or food constituents are irradiated depends on the micro-environment of the enzyme molecules. The extent of the indirect action is greatly reduced when the radiation is carried out in the frozen state, since then only water radicals formed in the bound water of the protein will participate. In many cases considerable reduction in radiation damage can thus be achieved by irradiation at low temperatures. This may be of some practical importance as the radiosensitivity of bacterial spores is only slightly affected by the irradiation temperature. When enzymes are exposed to ionizing radiation, the activity will continue to decrease after the end of the irradiation. This after-effect can be of considerable magnitude for certain enzymes. Thus, for Mucor pusillus protease it has been found that after doses which reduced the activity to 50% more than half of the remaining activity disappeared in the after-effect. If irradiation is used for sterilization of enzyme preparations, the after-effect will add to the inactivation occurring during irradiation. Also, a reduction in the heat-sensitivity of enzymes is observed after irradiation. The kinetic properties of an enzyme are in many cases altered after exposure of the enzyme preparation. Thus, the K_m for substrate may be affected, the requirements for co-factors may be increased or reduced, and the specificity of an enzyme may be altered. The possibility should be considered of using ionizing radiation for specific modification of enzyme properties. Specific protection of an enzyme can frequently be achieved by irradiation of the enzyme

in the presence of ligand molecules. This specific protection is probably caused by small conformational changes in the protein. The possibility is considered of using ionizing radiation combined with specific protection to reduce undesired enzymatic activities of enzyme preparations used in the food industry. (auth)

11522 IMMOBILIZATION OF ENZYMES BY THE RADIO-POLYMERIZATION OF ACRYL AMIDE. Kawashima, K.; Umeda, K. (National Food Research Inst., Tokyo). pp 119-128 of Improvement of Food Quality by Irradiation. Vienna; International Atomic Energy Agency (1974).

From meeting of the study group on the improvement of the quality of foods by irradiation; Vienna, Austria (18 Jun 1973). See STI/PUB-370; CONF-730684-.

Several enzymes were immobilized by radiopolymerization of acryl amide. A spongy membrane entrapping enzymes was obtained by irradiation treatment in the frozen state. The polymerization rate was increased by the addition of starch and by lyophilization treatment. Glucose oxidase (with an enzyme activity recovery of 12.3 to 33.7%), invertase (69.2%), D-amino acid oxidase (25.0, 70.5%), acylase (39.2, 43.7%), mould α-amylase (18.0%), malt β-amylase (4.1%), glucoamylase (6.5%), alkaline protease (5.3%), neutral protease (10.5%) were immobilized. Invertase entrapped by this method had a wider optimum range of pH but little change was observed in the temperature-activity profile. (auth)

11523 CATALYTIC AND PHYSICAL PROPERTIES OF γ-IRRADIATED CATALASE IN DILUTE SOLUTION. Gasyna, Z.; Bachman, S. (Technical Univ., Lodz, Poland). Nukleonika; 19: No. 10, 861-867(1974).

The catalytic and physical properties of irradiated beef liver catalase were studied. Modification of the enzyme by γ rays brings about its reducibility by dithionite. The decrease of the catalytic activity corresponds to the decrease in the content of nonreducible catalase. Microaggregates of catalase molecules induced by irradiation were fractionated. The results lead to the conclusion that aggregates are composed of active and modified catalase monomers. (auth)

11524 MOLECULAR MECHANISMS IN PHOTOBIOLOGY. III. Flash Photolytic Studies of the Intermediates Produced in the Photo Damage to Aliphatic Amino Acids and Oligopeptides in Aqueous Solution. Mittal, L. J.; Mittal, J. P.; Hayon, E.; Shankar, J. (Bhabha Atomic Research Centre, Bombay). pp 259-265 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Flash photolysis at a wavelength of ~200 nm of aliphatic amino acids and oligopeptides was studied in an attempt to understand the effects of protonated and deprotonated amino and carboxyl groups in the photochemistry of these compounds. Among the compounds studies were the N-acetyl derivatives of glycine, alanine, sarcosine, glutamic acid, and glycyl-glycine and their esters and amides, the amino acids glycine and alanine, diketopiperazines, aliphatic carboxylic acids, and the oligopeptides di-, tri-, and tetraglycines. The direct optical excitation of these compounds led primarily to a photo-induced decarboxylation. The acid amides and diketopiperazines had no transient states which indicated the importance of the carboxyl group in the photolysis. Dependence of the transient yield on the light intensity indicated that the aliphatic carboxylic acids, the amino acids, and oligo peptides proceeded by a monophotonic adsorption, but the decarboxylation of the acetylated molecules was biphotonic. (JSR)

11525 IRRADIATION OF NAD. P. 1. Adenine and Adenine Derivatives. Schachinger, L.; Heindl, B. (Gesellschaft Fuer Strahlen- und Umweltforschung m.b.H., Neuherbert/Muenchen (F. R. Germany)). Atomkernenergie; 24: No. 1, 43-50(1974). (In German).

8 figs.; 2 tabs.; 18 refs.

Nicotinamide-adenine-dinucleotide (NAD) and its components adenosine-diphosphate (ADP) and adenosinemonophosphate (AMP) play a key role in intermediary metabolism. The scope of this publication and of a following one is the investigation of the properties of all fragments which could be theoretically produced by irradiation of NAD. We were also interested in the secondary changes induced in these fragments by further irradiation. The behavior of NAD itself after irradiation will be the subject of a future publication. All radiation-induced changes of the adenine molecule and its derivatives were irreversible in vitro and could be explained as a result of reactions of the unstable radiolysis products of water with the substrates in question. Splitting of the ring-structure of the purine- and pyrimidine-bases as well as of the glycosidic linkage was found in nucleosides and nucleotides. The liberation of bases and sugars is the reverse procedure of the nucleoside synthesis. The irradiation yield of the splitting of the heterocyclic ring decreased from adenine to adenosine, AMP, ADP and ADP-ribose. This results can be explained by the assumption that the yield of the radiolysis products of water rather than the concentration of the substrate is rate-determining. The linearity of the dose-effect curve or the constancy of the G-values held down to substrate concentrations of 1.5×10^{-4} M. At still lower concentrations deviations from linearity occurred. (auth)

11526 A STUDY OF UV-TREATED BU-DNA: BEARING ON ITS CAPACITY TO FORM HYBRIDS WITH FAST-LABELLED RNA. Dacheva, M. A. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 63-68(1972).

A study was made of the radiosensitizing effect of bromouracil in vitro. As an experimental model, use was made of the ability of DNA to create hybrids with rapidly-tagged RNA. A comparison is given for the lowering in hybridization ability of normal DNA and of DNA from E. coli containing bromouracil after irradiation with ultraviolet light. DNA containing bromouracil has an increased sensitivity to irradiation, as is confirmed by the presence of a direct radiosensitizing effect of bromouracil during use of that system. (tr-auth)

11527 RADIATION DAMAGE TO THE RENATURATION CAPACITY OF DNA CAUSED BY THE EFFECTS OF PROTONS, HEAVY IONS AND GAMMA RAYS. Marinova, T. I.; Petrova, S. N.; Todorov, S. L. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)); Govorun, R. D.; Rizhov, N. I.; Grigoriev, Y. G. (Ministerstvo Zdravookhraneniya SSSR, Moscow). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 57-62(1972).

Experimental data were reported on the damage to the renaturation capacity of denatured DNA by irradiation with protons, heavy ions, and γ rays. The use of this biological model can lead to conclusions on the necessary monitoring of the different forms of ionizing radiation, decreasing the possibility of complementary bonds of DNA in one chain. During different monitoring of irradiation with protons, heavy ions, and γ radiation, results were obtained which indicated that the comparative results of these monitorings were subject to discussion. (tr-auth)

11528 EFFECT OF FAST NEUTRONS ON HUMAN GAMMA GLOBULIN AND SERUM ALBUMIN. Stefanova, M.; Sveshtarova, M.; Vasileva, V. (Vissh Meditsinski Inst., Plovdiv (Bulgaria); Vissh Selskostopanski Inst., Plovdiv (Bulgaria). Katedra po Obshta Khimiya). Folia Med. (Plovdiv); 14: No. 5, 295-304(1972).

Differential spectra are made of the irradiated, with different doses of fast neutrons, human gamma globulin and human serum albumin and model mixture of aromatic amino acids in relation to native protein. Minimal values shown in differential spectra of irradiated proteins enable us to assume that shifts in the position of the chromophores begin towards the surface of the globula. The red shift which is observed at the maximum of the absolute spectra is probably due to ionization of the phenol group in the tyrosyl residues. The curves of titration used in calculating the number of free phenol groups were also drawn. The additional alkaline denaturation does not lead to further noticeable changes. (auth)

11529 FLUORESCENT PRODUCTS FROM IRRADIATED AMINO ACIDS AND PROTEINS. Adhikari, H. R.; Tappel, A. L. (Univ. of California, Davis). Radiat. Res.; 61: No. 1, 177-183 (Jan 1975).

Upon γ-irradiation, glutamic acid, phenylalanine, serine, arginine, and methionine in aqueous solution formed appreciable amounts of malonaldehyde and small but measurable quantities of fluorescent compounds. The fluorescence yield was dose dependent within the range 100–1000 krads, and was fairly proportional to the amount of malonaldehyde formed. Irradiated amino acids that did not form malonaldehyde did not develop fluorescent products. Spectral characteristics of the fluorescent products and other analytical data suggested the presence of a Schiff-base type linkage, probably formed by conversion of some of the amino acid to malonaldehyde and its subsequent reaction with other amino acid molecules to form a Schiff base. This study shows the possible usefulness of fluorescence measurements to assess radiation damage to amino acids and proteins. (auth)

Radiation Effects on Cells

Refer also to abstracts 11602, 11603, 13482, 13517, 13522, and 13529.

11530 (STI/DOC-10/159) CALIFORNIUM-252 IN TEACHING AND RESEARCH. Hall, E. J.; Rossi, H. H. (International Atomic

Energy Agency, Vienna (Austria)). Aug 1974. 147p. IAEA $7.00.

Californium-252 provides a portable source of neutrons for use in teaching and research programs. A range of experiments in biophysics and radiobiology using ^{252}Cf as a neutron source are presented. Radiation protection requirements for handling ^{252}Cf are unusually complex since the emission is a mixture of γ rays and neutrons. Basic concepts of radiation physics, radiobiology, and dosimetry are reviewed with emphasis on their relevance to the safe handling of ^{252}Cf. (CH)

11531 X-IRRADIATION OF MITOTIC CHINESE HAMSTER CELLS. II. Evidence for Cell-Doublet Survival Response Before Karyo- and Cytokinesis. Nagle, W. A. (Texas Univ., Dallas); Humphrey, R. M. Int. J. Radiat. Biol.; 26: No. 3, 289-295(Sep 1974).

An investigation of the survival response of non-lethally irradiated mitotic Chinese hamster ovary cells gave results suggesting that, after x-irradiation of the mitotic cells with 100 rads or more, only one of the resulting daughter cells was a viable colony former. Thus, single mitotic cells apparently responded to x-irradiation as though they were already two-cell units, even though the irradiation was delivered before karyo- and cytokinesis. (UK)

11532 BASE PAIRING AND TEMPLATE SPECIFICITY DURING DEOXYRIBONUCLEIC ACID REPAIR SYNTHESIS IN HUMAN AND MOUSE CELLS. Lieberman, M. W.; Poirier, M. C. (National Cancer Inst., Bethesda, MD). Biochemistry; 13: No. 26, 5384-5388(17 Dec 1974).

Nucleotide insertion during DNA repair synthesis was studied in cultured human diploid fibroblasts (WI-38) and Balb/c 3T3 mouse cells damaged with ultraviolet radiation and two mutagenic carcinogens, N-acetoxy-2-acetylaminofluorene (NA-AAF) and 7-bromomethylbenz[a]anthracene (7BrMeBA). Evidence from thermal elution chromatography, S_1 nuclease digestion studies, and pyrimidine isostich analysis suggests that in mammalian cells the complementary, undamaged strand serves as a template for repair synthesis and that the result of such synthesis is the accurate restoration of the damaged area to the original nucleotide sequence. (auth)

11533 THERMAL SENSITIVITY AND THE EFFECT OF ELEVATED TEMPERATURES ON THE RADIATION SENSITIVITY OF CHINESE HAMSTER CELLS. Robinson, J. E.; Wigenberg, M. J. (Univ. of Maryland, Baltimore). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 241-248(1974).

Thermal survival curves for Chinese Hamster cells are exponential with a shoulder. There is net proliferation at 40°C with a rapid increase in thermal sensitivity above that temperature. There is synergistic action between the lethal effects of mild thermal treatments and irradiation. Significant sensitization occurs at 40°C, while cells treated at 42°C are more than twice as radiation sensitive as normal temperature controls. It is not necessary to heat during irradiation to achieve thermal radiation sensitization. (auth)

11534 DOSE SUFFICIENT FOR THE X-RAY INHIBITION OF MELANOMA CELL REPLICATION IN SUSPENSIONS USED FOR AUTOIMMUNIZATION AGAINST MALIGNANT MELANOMA. Valkov, V.; Ikonopisov, R. L.; Stojanov, I. Sb. Tr., Nauch.-Izsled. Onkol. Inst., Sofia; 14: 25-30(1972).

Experiments are carried out on Syrian golden hamsters implanted with irradiated melanoma cell suspensions. Takes and growth of the tumors are followed up in groups of hamsters injected with suspensions irradiated with doses of 500, 1000, 5000, 8000, 10,000, 12,000 and 21,000 rads. Tumor infiltrations and nodules are checked on the 6th and the 10th day following inoculation. While the size of the tumors diminish with the increase of the dose, there is no growth whatever with cell suspensions irradiated with 8000 up to 21,000 rads. Control animals injected with suspensions of live melanoma cells without being subjected to irradiation grow to the size of 12 mm and 15 mm in diameter on the 6th and the 10th day respectively. It is assumed that irradiation with 12,000 rads, a dose $\frac{1}{3}$ higher than the dose at which no growth occurs, should be considered safe and should be accepted as satisfactory for autografting of irradiated malignant melanoma cells. (Abstr. Bulg. Sci. Med. Lit.)

11535 CORRELATION BETWEEN DNA STABILITY AND PROTEIN EXTRACTION IN NONIRRADIATED AND X-IRRADIATED BONE-MARROW CELLS. Benes, L.; Rotreklova, E. (Inst. for Biophysics, Brno). Stud. Biophys.; 44: No. 1, 67-76(1974). (In German).

The stability of DNA to acid hydrolysis was studied in relation to the extraction of proteins. The hydrolysis was carried out with 1 M HCl at 60°C, the extraction of proteins with 0.2 M H_2SO_4 or with 0.14 M NaCl (pH 5.8). The cells were synchronised with thymidine blocking. Using the mentioned solutions, the extraction rate of the cells in the S-phase was higher than of those in the G_1-phase. The exposition of cells to 600 R increased the rate of protein extraction. After exposure to 600 R the amount of AS-DNA decreased. The same effect was observed after H_2SO_4 extraction. On the other hand, the NaCl-extraction did not change the ratio of AL-DNA: AS-DNA. The H_2SO_4-extraction of cells was discussed with respect to the histones and that with NaCl to globulins. (auth)

11536 STUDY OF THE EFFECT OF GAMMA RADIATION ON THE ONCOGENIC PROPERTIES OF CELLS OF ROUS SARCOMA CULTURES. Andonov, P. S.; Todorov, L. I. (Nauchno-Izsledovatelski Inst. po Epidemiologiya i Mikrobiologiya, Sofia (Bulgaria)); Ivanov, B.; Todorov, S. L. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)); Uzunov, P. V. (Institut za Spetsializatsiya i Usyvyrshenstvuvane na Lekarite (ISUL), Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 69-78(1972).

Rous sarcoma cells underwent a dose of 500 R, and gradually recovered the properties of a single-layer culture. Doses of 2000 to 10,000 R lead to disarray in cell population and an inability to form a single-layer culture. A favorable correlation is established between the ability of cells irradiated at 500 R to multiply, and their oncogenic activity in hamsters and baby chickens. An organic relation is manifested between the virus genome and the ability of the cell-host to multiply. A number of histopathological changes are established in tumors which are formed after inoculation with cells subjected to irradiation in comparison with the structure of tumors after inoculation with cells which were not irradiated. (tr-INIS)

11537 EXPLOITATION OF KINETIC DIFFERENCES BETWEEN NORMAL AND MALIGNANT CELLS. Brown, J. M. (Stanford Univ., CA). Radiology; 114: No. 1, 189-198(Jan 1975).

From symposium on cell kinetics, models, and cancer treatment at the 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

Some of the differences in the proliferation kinetics of normal and malignant tissues may be used to increase radiation damage to tumor cells. Of these various possibilities, some are still at a theoretical stage (mainly because there are no means of obtaining the needed data) but others, notably those involving a combination of cycle-linked chemotherapeutic and/or radiosensitizing drugs with radiation, may be exploitable now with the expectation of clinical benefit. (auth)

11538 POSTREPLICATION REPAIR OF DNA IN MAMMALIAN CELLS. Lehmann, A. R. (Univ. of Sussex, Eng.). Life Sci.; 15: No. 12, 2005-2016(15 Dec 1974).

Postreplication repair of DNA is reviewed under the following headings: postreplication repair in bacteria; mechanisms of DNA replication in damaged cells; size of DNA made in uv-irradiated cells; mechanism of gap-filling; recovery of ability to synthesize high molecular weight DNA at late times after irradiation; gap-filling in xeroderma pigmentosum cells; postreplication repair in cells damaged with chemicals; and relationship of postreplication repair to mutation, chromosome aberrations, and carcinogenesis. (HLW)

11539 COMPARISON OF THE RADIATION SENSITIVITIES OF THYMIC AND THORACIC DUCT LYMPHOCYTES. Geraci, J. P.; Christensen, G. M.; Jackson, K. L. (Univ. of Washington, Seattle). Radiat. Res.; 61: No. 1, 158-163(Jan 1975).

The dose-response curve for adenine incorporation, an index of cell death when measured 24 hr after irradiation, was biphasic for both thymic and thoracic duct lymphocyte populations x-irradiated in vitro. However, the magnitude of reduced adenine incorporation was greater for thymic lymphocytes than for thoracic duct lymphocytes at each dose examined. Measurement of the rate of injury development in the two cell populations indicates that the difference between the two dose-response curves is the result of a slower rate of injury development in thoracic duct lymphocytes. Correction for differences in rate of injury development indicates that the radiosensitivities of the two types of lymphocyte populations are identical. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 10717, 11484, 11490–11496, 11519, 11538, 11555, 13507, and 13516.

11540 (AEC-TR-7592, pp 47-49) INFLUENCE OF γ-RAYS AND TEMPORARY FACTORS ON PLANKTONIC BIOCOENOSIS.

Razyulite, R. N.; Yankyavichyus, K. K.; Saulenayte-Budriene, S. F.; Yankavichyute, G. Yu. (Inst. of Botany, Vilnyus, USSR). Dec 1974. Translated from pp 73-77 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The data of a 79-day experiment indicate that doses of 1000 kr are not sterilizing for bacterioplankton and phytoplankton, while zooplankton is killed at doses above 20 kr. Bacteriologically pure cultures of algae are more sensitive to irradiation than algae included in the composition of a planktonic biocoenosis. Different algae species do not respond identically to the same doses of γ-radiation. The amounts of free amino acids in the cells and in the algae medium depend on the intensity of the development of the algae. (auth)

11541 (AEC-TR-7592, pp 74-78) METHOD OF CHEMILUMINESCENCE USED IN STUDIES ON THE INTERACTION OF RUTHENIUM SUBMICROQUANTITIES WITH ORGANIC SUBSTANCES DISSOLVED IN NATURAL WATERS. Koshcheeva, I. Ya.; Varshal, G. M.; Velyukhanova, T. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Dec 1974. Translated from pp 116-122 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Ru (IV) has a catalytic activity in the chemiluminescent reaction of luminol oxidation by hydrogen peroxide. The inhibiting effect of organic substances on the catalytic activity of Ru (IV) in the chemiluminescent reaction can be described in the following series: acetic acid, trimethyl amine, ethylamine, urea, tartaric and oxalic acids, glycolic acid, glycine, and phenol. In this series, the stability of the complex compounds with Ru (IV) increases from acetic acid to phenol. Organic substances of Biezna River, 80 percent of which are humus substances and polyphenols, form complexes with Ru(IV) very well. This is connected with the nature of the functional groups of these substances. Complexing of Ru with organic substances accounts for the high mobility of radioruthenium (^{103}Ru + ^{106}Ru) in waters and soils and the possibility of its accumulation in biological media. (auth)

11542 (AEC-TR-7592, pp 82-85) METHODS FOR DETERMINING THE ACCUMULATION OF RADIONUCLIDES BY PLANTS FROM AQUATIC ENVIRONMENT. Kharchuk, A. I. (Scientific Research Inst. of Medical Radiology, Moscow). Dec 1974. Translated from pp 128-132 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The accumulation of P^{32}, Ca^{45}, and Sr^{90} by peas was investigated when radionuclides were introduced into the nutrient medium once. For determining the potential possibility of accumulation of radionuclides by plants, it is necessary for the concentration of radionuclides and the nutritional elements in the medium to be constant. (auth)

11543 (CONF-740991-1) DEPENDENCE ON GROWTH PHASE OF ULTRAVIOLET SENSITIVITY IN PYRIMIDINE DIMER-EXCISION MUTANTS OF BACILLUS SUBTILIS. Hadden, C. T.; Billen, D. (Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences; Oak Ridge National Lab., Tenn. (USA)). 1974. Contract AT(40-1)-3596. 28p. Dep. NTIS $4.50.

From symposium on neoplastic immunity: theory and application; Chicago, Illinois, USA (11 Sep 1974).

The survival of Uvr^+ and Uvr^- strains of Bacillus subtilis after ultraviolet irradiation was compared using two Uvr^- mutations, uvr-1 and uvs-42. In some genetic backgrounds, stationary-phase cultures of the Uvr^- mutants comprise two populations, one of which, the resistant fraction, appears to have about the same uv sensitivity as Uvr^+ strains. After starvation for thymine, the resistant fraction was larger, but chromosome alignment by amino acid starvation did not increase the resistant fraction above what it had been in stationary-phase cultures. In a different genetic background the same Uvr^- mutations did not show a marked uv-resistant population in stationary phase, implying that an alternative repair system or different regulation of repair of uv damage may operate in some strains. (auth)

11544 (IAEA-159, pp 3-14) MICROBIOLOGICAL CONTROL BEFORE AND AFTER STERILIZATION: ITS EFFECT ON STERILITY ASSURANCE. Artandi, C. (Ethicon Inc., Somerville, NJ). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The problems associated with conventional sterility are reviewed. The role of biological indicators and model systems in sterility process control is discussed, and the importance of an awareness of product contamination and plant hygiene in terms of sterility assurance is emphasized. Actual in-plant experience with sterility control procedures is described. (auth)

11545 (IAEA-159, pp 15-27) SENSITIVE DETECTION MEDIUM FOR THE ENUMERATION OF PATHOGENIC STAPHYLOCOCCUS AUREUS. Anderson, A. W.; Chugg, L. (Oregon State Univ., Corvallis). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Staphylococcus aureus is one of the most dangerous of hospital pathogens, being highly irradiation resistant, resistant to drying, and often resistant to antibiotics. A medium was designed which enhances recovery, is selective, and identifies the pathogenic staphylococci. The ingredients which enhance recovery, increase selectivity, and identify the coagulase positive staphylococci are pyruvate, pig plasma, and fibrinogen. The significance of these ingredients is discussed in some detail. (auth)

11546 (IAEA-159, pp 29-35) RADIATION-INDUCED MUTANTS WITH INCREASED RESISTANCE AGAINST IONIZING RADIATION. Christensen, E. A. (Statens Seruminstitut, Copenhagen). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The selection of strains of bacteria with a significant increase of resistance against ionizing radiation as compared to the resistance of the original strains is described. The influence of the mutants induced by the industrial use of radiation on the recommendations for radiation sterilization of medical products is discussed. (auth)

11547 (IAEA-159, pp 37-42) RADIATION INDUCED RADIATION RESISTANCE IN MICROCOCCUS RADIODURANS, STRAIN R_1. Emborg, C.; Eriksen, W. H. (Atomic Energy Commission Research Establishment, Risoe, Denmark). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

In course of the routine operations of the large radiation sources, the microflora in the surrounding environments are likely to be exposed to intermittent cycles of radiation doses. Such practices might pose a risk of inducing and preferentially selecting microbial mutants having enhanced radiation resistance as well as other undesirable characters such as virulence, antibiotic resistance among others. The case of appearance of highly radioresistant Micrococcus radiodurans has been discussed. A prototype experiment including exposure to 25 intermittent radiation cycles has shown induced mutants with increased radioresistance, prolonged generation time and bigger cell size. It has been concluded that surveillance of this nature should add to the safety of public health in the age of increased industrial applications of atomic energy. (auth)

11548 (IAEA-159, pp 43-49) ISOLATION OF RADIATION RESISTANT MICROORGANISMS FROM THE ENVIRONMENTS OF COBALT-60 SOURCES; PRELIMINARY RESULTS. Kristensen, H. (Statens Seruminstitut, Copenhagen). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Radioecological investigations were undertaken at and in the surroundings of the large radiation sources used for industrial practices including radiation sterilization of medical devices. The preliminary reports deal with the observations on the microflora of the pool waters shielding the ^{60}Co-gamma source and the effects of chronic high level gamma radiation exposures received by those microorganisms as an environmental stress. Bacterial colonies (of gram positive rod) have been isolated from the gamma pool waters showing high level of radioresistance and characteristic pigmentation. It is interpreted that the very high level background radiation of the environment has acted as the selective factor leading to the occurrence of those mutants characterized by their high radiation resistance. The paper discusses the need for protective surveillance against the possible appearance of unfavorable mutant microorganisms in the environment of nuclear reactors and other large industrial scale nuclear facilities. (auth)

11549 (IAEA-159, pp 67-87) SELECTION OF TEST STRAINS AND THE CHOICE OF METHODS FOR PREPARATION OF BIOLOGICAL MONITORS FOR CONTROL ON RADIATION STERILIZATION. Christensen, E. A. (Statens Seruminstitut, Copenhagen). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

A test strain for a sterilization method must be very resistant against the given method compared to the average resistance of all the microorganisms in the given environment. Several other characteristics of the strain of bacteria which may be chosen as a test organism are also important. The selection and the choice of three different strains of bacteria for control of radiation sterilization of medical equipment are described. (auth)

11550 (IAEA-159, pp 89-96) RADIATION INACTIVATION OF DRIED PREPARATIONS WITH SPORES OF VARIOUS BACILLUS STRAINS AND THEIR POSSIBLE USE IN CONTROL OF RADIATION STERILIZATION PROCEDURES. Emborg, C.; Eriksen, W. H. (Atomic Energy Commission Research Establishment, Risoe, Denmark). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Dried preparations with spores of B. sphaericus, strain C_1A; a family of mutants of B. cereus; and B. pumilus, strain E 601, have been evaluated for their suitability as biological dose monitors in the routine control of radiation sterilization procedures. It is concluded that the most accurate and informative control is achieved by counting the survivors in test pieces with spores of B. sphaericus, strain C_1A. A Go no-Go routine control system can be established by use of various mutants of B. cereus prepared and used as conventional biological indicators. (auth)

11551 (IAEA-159, pp 181-185) PUBLIC HEALTH ASPECTS OF RADIOSTERILIZATION. Cohen, Y. (CEN de Saclay, Gif-sur-Yvette, France). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

A general review of the sterilization practices (including radiosterilization) for medical products, devices, drugs, and derivatives from the biological tissues for clinical and therapeutic purposes is presented. A timely need for the revision of the IAEA/WHO Recommended Code of Practice has been emphasized. The relevant items of the WHO document (1971) entitled Good Practices in the Manufacture and Quality Control of Drugs has been cited for possible inclusion in the IAEA/WHO Recommended Code of Practice as the guide line for manufacture, packaging, monitoring, dosimetry calibration, radiosterilization, sterility testing and maintenance of hygienic standards of the production sites. (auth)

11552 (IAEA-159, pp 187-191) RADIATION STANDARDIZATION FOR DRUGS AND DEVICES. Macek, T. J. (United States Pharmacopeia, Rockville, MD). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Various experiences in different parts of the world have focused attention in recent times on certain inadequacies in the sterilization systems and processing methods for drugs and devices. There is an urgent need for the development of improved methods and the definition of new standards and better controls. Radiation offers some possibilities for improvement, but differences in views need to be resolved in order to provide a more uniform approach to the resolution of problems that are shared in common. Proposals are offered for consideration. (auth)

11553 (IAEA-159, pp 211-219) REVIEW OF MICROBIOLOGICAL ASPECTS OF THE CODE OF PRACTICE FOR RADIATION STERILIZATION. Christensen, E. A. (Statens Seruminstitut, Copenhagen). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

The probability of sterility of radiation-sterilized products must be the same as for products sterilized by other methods. Therefore the recommendations for microbiological control on radiation sterilization and radiation-sterilized products must be equivalent to the recommendations for other sterilization methods. Further the biological reference standard(s) on which the choice of dose for the radiation-sterilized products may be based must be equivalent to the accepted biological indicators for other sterilization methods. It must be considered reasonable to protect the patient by demanding the same degree of safety regardless of which sterilization method is applied for the medical products used for the treatment of the patient, and regardless of whether the sterilization is performed at a hospital or in industry. (auth)

11554 (IAEA-159, pp 223-241) STERILIZATION OF HUMAN CARDIAC VALVES BY GAMMA RADIATION. Fleurette, J.; Transy, M. M. J.; Mikaeloff, P. (Hospital Cardiologique, Lyon). 1972. (In French).

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Data are presented on the suitability of application of radiation sterilization of human cardiac valves for purposes of transplantation therapy. The cardiac valves were controlled for the microbial contamination before sterilization by irradiation and the counts as well as the types of the contaminants were identified. Sterilization dose of 2.5 Mrads was applied in which the complete sterility was achieved and the collagen fibrils were found to remain in a satisfactory condition. It is believed that 2.5 Megarads level could even be lowered without affecting the safety assurances for the sterility of the products. (auth)

11555 (IAEA-159, pp 243-250) GRAFT REGISTRY OF THE HUMAN TISSUE BANK OF GREECE. Triantafyllou, N. (Democritus Nuclear Research Centre, Athens). 1972.

From proceedings on the revision of the IAEA recommended code of practice for the radiation sterilization of medical products; Risoe, Denmark (5 Jun 1972).

Methods of sterilization of tissue allo-grafts by gamma radiation are described as carried out by the human tissue bank of Greece. The sterilizing dose used is of the order of 3.5 Megarads. Dosimetry monitoring is carried out by the use of Red Perspex 400, irradiated together with the samples. Post sterilization bacteriological tests for sterility control are conducted. Additional steps to improve the radiation sterilization practices of tissue allografts and their safety assurances against cross infection are discussed. (auth)

11556 (ICP-1059) CONTROL OF MICROORGANISMS POPULATION IN FUEL STORAGE BASIN WATER USING ULTRAVIOLET LIGHT. Wilding, M. W. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs-Operations Office). Nov 1974. Contract AT(10-1)-1375. 13p. Dep. NTIS $4.00.

The fuel storage basin at the Idaho Chemical Processing Plant (ICPP) is used as an interim storage facility for irradiated fuel. The depth of the water in the basin is approximately 20 feet, and the total basin contains approximately 1.5×10^6 gallons of water; the total dissolved solids concentration in the water is about 1000 mg/l. To identify and handle fuel elements under 20 feet of water, good water clarity is essential. At the ICPP chlorine is added to the water periodically to prevent the growth of those microorganisms which produce turbidity in the water; however, chlorine eventually is converted to chloride ion, which is potentially corrosive to the aluminum-clad fuel elements that are stored in the water. Another possible method of inhibiting the growth of microorganisms, while avoiding the formation of chloride ion in the water, is to pass the water through an ultraviolet light sterilizer. Laboratory experiments showed that 99% of the microorganisms in the fuel storage basin water on the makeup well water are killed by ultraviolet radiation. The installation, operating principles, and safety precautions of ultraviolet light sterilization equipment are discussed. (auth)

11557 (SAND-74-5511) RATES OF MUTANT PRODUCTION IN BACILLUS SUBTILIS BY DRY HEAT AND GAMMA IRRADIATION. Dillon, R. T.; Conley, M. B. (Sandia Labs., Albuquerque, N. Mex. (USA); New Mexico Univ., Albuquerque (USA)). [nd]. 26p. (CONF-741082-1). Dep. NTIS $4.60.

From 6th international spore conference; East Lansing, Michigan, USA (10 Oct 1974).

Bacillus subtilis var. niger spores were inactivated by dry heat, γ irradiation, and combination of the two. The percentage of auxotrophic mutants among the survivors was determined as a function of treatment time over seven decimal reductions of the initial population. For dry heat inactivation the percentage of mutants increased to a maximum and then decreased. In general, similar results were obtained with γ irradiation although there were more peaks and valleys in the percentage of mutants as a function of irradiation. For some combinations of dry heat and simultaneous irradiation the percentage of mutants obtained was greatly reduced. (auth)

11558 REDUCTION IN OXYGEN ENHANCEMENT RATIO WITH INCREASE IN LET. Tests of Two Hypotheses. Alper, T.; Bryant, P. E. (Hammersmith Hospital, London). Int. J. Radiat. Biol.; 26: No. 3, 203-218(Sep 1974).

Measurements of oer and of the oxygen constant K may be used to calculate effective concentrations of oxygen engendered in the tracks of ionizing particles, if it is correct to invoke that phenomenon to account for decreasing oer with increasing LET. Effective O_2 concentrations calculated from results with Shigella flexneri and Chlamydomonas reinhardii were in good agreement, although the radiobiological responses of those organisms were widely different in several respects. The relevant oxygen concentrations so calculated accounted plausibly also for variations of oer with radiation quality in mammalian cells. Tests were also formulated to examine the validity of the interacting-radicals hypothesis of Alper (1956, Radiat. Res., 5, 573) and Howard-Flanders (1958, Adv. Biol. Med. Phys., 6, 553) by the use of data on changes in oer and biological effectiveness with radiation quality. These tests have failed to support the latter hypothesis. (auth)

11559 GENETICHESKII KONTROL' RADIO-CHUVSTVITEL'-NOSTI BAKTERII. (Genetic Control of Radiation-Sensitive Bacteria). Myasnik, M. N. Moscow; Atomizdat (1974). 152p.

New concepts on the nature of radiation sensitivity of bacteria are presented. Analysis of a large amount of experimental material suggests that genetic control of this sensitivity is based in the genes which control the synthesis of cell membrane components. This hypothesis explains many of the phenomena observed in the experiments. Considerable attention is given to environmental factors which affect the radiation-biological reactions in E. coli strains which differ in sensitivity and genotype. By combining different cultivation conditions and using them in different combinations, it is possible to modify the appearance of radiation-induced damage to various cell structures. Further, it is then possible to estimate the contribution of the damage of the different structures (DNA or cell membrane) to a lethal outcome. The book is designed for radiation biologists, geneticists, biochemists, biophysicists, and microbiologists. 43 illustrations, 12 tables, 186 references. (tr-auth)

11560 BACTERIOPHAGES OF PROPIONIBACTERIUM ACNES. Pulverer, G.; Sorgo, W.; Ko, H. L. (Univ., Cologne). Zentralbl. Bakteriol. Parasitenk., Abt. I; 225: 353-363(Dec 1973). (In German).

The aim of our study was to isolate phages from 69 Propionibacterium acnes strains with the help of spontaneous release of phages and induction with uv rays, Novobiocin, and Mitomycin C. Of these only spontaneous lysogeny and induction with Mitomycin C proved to be useful. Altogether 26 P. acnes phages could be isolated and propagated. Together with the only hitherto known phages 26 and 174 our 26 P. acnes phages were differentiated according to their activity spectrum, their resistance to uv rays, hydroxylamine, and acridine orange in the dark. Six of the 28 phages were selected for phage-typing because of their good activity spectrum. The 69 P. acnes strains could be grouped into seven phage-groups. Our studies demonstrate that P. acnes strains are frequently lysogenic (at minimum 38%). It seems therefore worthwhile to try to establish a phage-set for phage-typing of P. acnes. (auth)

11561 DEPRESSION OF DIMER EXCISION IN REC$^-$ UVR$^+$ MUTANT OF ESCHERICHIA COLI K-12. Slezarikova, V.; Masek, F.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 44: No. 1, 1-6(1974).

By pre-irradiation inhibition of DNA and protein synthesis it is possible to induce depression of dimer excision in the E. coli K-12 SR19 rec$^-$ uvr$^+$ strain. This treatment has no influence on the viability of cells; it enhances their resistance to uv radiation. It seems that in these cells integrity of rec loci is not necessary for postreplication repair. (auth)

11562 SURVIVAL AND THYMINE-DIMER EXCISION AFTER PREIRRADIATION THYMINE DEPRIVATION PRECEDED AND ACCOMPANIED BY AMINO-ACID STARVATION IN ESCHERICHIA COLI. Maskova, L.; Masek, F.; Sedliakova, M. (Cancer Research Inst., Bratislava). Stud. Biophys.; 44: No. 1, 51-56 (1974).

The relation between uv resistance and thymine-dimer excision of two excision-proficient bacterial strains, Escherichia coli B/r Hcr$^+$ and Escherichia coli 15 555-7, was followed. Thymine starvation applied at a certain interval of preirradiation amino-acid starvation in the above-mentioned strains will not influence uv resistance of cells and will not depress thymine-dimer excision. It seems that depression of dimer excision can only be induced in cells that are in phase of active division. (auth)

11563 RADIO STERILIZATION OF THE BULGARIAN PLASMA EXPANDER "HAEMODEX". Keslev, D. D.; Ovcharov, R.; Todorov, S. L. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)); Cholakova, G. (Inst. za Kontrol na Lekarstvenite Sredstva, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 79-84(1972).

A ^{60}Co γ source was used for the sterilization of the dry dextran–Heamodex. Preliminary studies showed that all series were sterilized. The γ dose used in the range from 0.5 to 2.5 Mrad sterilized sections of dry dextran deliberately contaminated with B. subtilis. The irradiated dextran showed no essential changes in the chemical and biological indicators. (tr-auth)

11564 MICROBIAL FLORA OF GAMMA-IRRADIATED VACUUM-PACKED GROUND BEEF STORED AT DIFFERENT TEMPERATURES. Okafor, N. (University of Nigeria, Nsukka (Nigeria). Dept. of Microbiology). J. Food Sci. Technol. (India); 10: No. 3, 95-101(Jul 1973).

16 refs., 8 figures.

Vacuum-packed ground beef was stored unirradiated, as well as after irradiation at doses of 0.1, 0.3, and 1.0 Mrads at storage temperatures of 1, 5, 15, 25, and 30°C. Pseudomonas and Microbacterium did not survive at lower irradiation doses. Organisms developing on media designed for Lactobacilli, yeasts, Streptococci, Coliforms, and Micrococci survived the 0.3 Mrad dose to varying degrees. Lactobacilli and yeasts predominated among the organisms surviving the 1.0 Mrad dose. Organisms which survived the higher irradiation dose on media designed for Coliforms and Streptococci were isolated mainly from meat packs incubated at higher temperatures (25 to 37°C). (auth)

11565 BIOLOGICAL PROPERTIES OF ANTIGENS AND CHEMICAL CHARACTERISTICS OF SPECIFIC POLYSACCHARIDES OBTAINED FROM S. TYPHI BACTERIA EXPOSED TO GAMMA IRRADIATION. Shibayeva, I.V.; Izvekova, A. V.; Ivanov, K. K.; Tumanyan, M. A. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Ehpidemiologii i Mikrobiologii). J. Hyg. Epidemiol., Microbiol., Immunol.; 17: No. 3, 357-363(1973).

Toxicity and the antigenic and immunogenic properties were studied of radioantigens obtained from S. typhi bacteria (strain Ty$_2$ 4446) exposed to gamma irradiation in doses of 0.6, 2.5, and 5 Mrad. The toxicity of the radioantigens was found to decrease with increasing radiation dose. Their antigenic and immunogenic properties as well as the preventive properties of sera to radioantigens did not differ from the properties of preparations obtained from non-irradiated bacteria. Specific polysaccharides were isolated from radioantigens to determine the correlation between the biological activity of the endotoxin and radiochemical changes in its components. The chemical composition of the specific polysaccharides was found to be identical with the composition of the polysaccharides obtained from non-irradiated bacteria. This is suggestive of a comparatively high stability of the polysaccharide component of the endotoxin in the bacterial cell. (auth)

11566 EFFECT OF LOW LEVEL GAMMA IRRADIATION ON GROWTH AND PATULIN PRODUCTION BY PENICILLIUM PATULUM. Bullerman, L. B.; Hartung, T. E. (Univ. of Nebraska, Lincoln). J. Food Sci.; 40: No. 1, 195-196(1975).

Spores as well as vegetative mycelia of two strains of Penicilliumm patulum were irradiated at 100 and 200 Krad to determine the effects on growth and patulin production. Irradiation of spores reduced subsequent growth in potato dextrose broth by both strains. Spores of one strain were more resistant to irradiation than spores of the second strain. Irradiation of mycelia resulted in variable growth response in subsequent cultures in potato dextrose broth. Cultures grown from irradiated spores and mycelia produced less patulin than nonirradiated control cultures. There was a marked reduction in the amount of patulin produced per mg of dry mycelia with both strains when grown from either irradiated spores or mycelia. (auth)

11567 APPEARANCE OF LIGASE-SPECIFIC RUPTURES IN THE DNA OF γ-IRRADIATED BACTERIA. Fomenko, L. A.; Gaziev, A. I.; Zakrzhevskaya, D. T.; Kuzin, A. M. (Inst. of Biological Physics, Pushchino-on-Oka, USSR). Dokl. Akad. Nauk SSSR; 214: No. 3, 698-700(21 Jan 1974). (In Russian).

The formation of ligase-specific ruptures in the DNA of irradiated Bac. subtilis Shyw. and Escherichia coli and the possibility of the regeneration of the DNA-ligase in cells were studied. The bacteria were grown in a medium with ^{3}H-thymidine, collected in the logarithmic phase, suspended in 0.05 M phosphate buffer containing 0.05 M EDTA at a pH of 8.0 and irradiated at 0 to 3°C with ^{60}Co γ rays at a dose rate of 2 krad/min to a total dose of 5, 10, and 20 krad. The results showed that during the γ irradiation of bacteria ligase-specific ruptures are formed in the DNA and these can be immediately coupled with ligases. The data indicate that for rapid reparation of breaks in DNA in vivo the ligase reactions require supplementary activation by cofactors. (JSR)

11568 PYRIMIDINE DIMER EXCISION AND MUTATION FREQUENCY DECLINE. Haak, R. A.; Bockrath, R. C. (Indiana Univ., Indianapolis). Radiat. Res.; 61: No. 1, 164-171(Jan 1975).

The relationship between pyrimidine dimer excision and mutation frequency decline has been clarified by obtaining quantitative data on the rates of the two processes in a single bacterial strain. The loss of potential revertants is significantly faster than the removal of thymine-containing dimers and the kinetics of dimer removal are similar whether the postirradiation environment is conducive to mutation frequency decline or not. (auth)

Radiation Effects on Plants

Refer also to abstracts 11530, 11540, 11691, 13505, and 13506.

11569 EFFECT OF GAMMA-IRRADIATION ON CELL ELONGATION AND AUXIN LEVEL IN AVENA COLEOPTILES. Miura, K.; Hashimoto, T.; Yamaguchi, H. (Tokyo Univ.). Radiat. Bot.; 14: No. 3, 207-215(Sep 1974).

To examine the effect of γ-irradiation on cell elongation, which is mediated by auxin, oat (Avena sp.) seedlings at various growth stages were irradiated. At a very young stage (2 mm coleoptile stage) where cell division was considered to be taking place, the growth of coleoptiles was inhibited by a low dose of radiation, whereas at an advanced stage (14 mm coleoptile stage) a higher dose was required to inhibit the growth of coleoptiles. The doses required for 50 per cent inhibition were 1 kR and 300 kR for the 2 mm and 14 mm stages respectively. In the latter stage no cell division occurred and growth inhibition was associated solely with the inhibition of cell elongation. A possible mechanism of inhibition of cell elongation by the high dose was sought. The conversion of tryptophan to indoleacetic acid (IAA) by an enzyme preparation extracted from irradiated coleoptiles was not greatly suppressed (by only 20 per cent at 500 kR). The auxin supply from the coleoptile tips to the growing zones and auxin transport in the coleoptiles were not affected at all by doses up to 680 kR. However, the growth responses to IAA of sections excised from irradiated coleoptiles were greatly reduced as compared to the non-irradiated controls. From these results it was concluded that cell elongation of Avena coleoptiles was inhibited by a high dose of γ rays through the reduction of reactivity to IAA. (auth)

11570 POST-IRRADIATION SENSITIVITY OF CREPIS CAPILLARIS SEEDS TO HIGH TEMPERATURE. Atayan, R. R.; Kagramanian, R. S.; Avakian, H. M. (Erevan Inst. of Physics). Stud. Biophys.; 44: No. 1, 77-80(1974).

Different combinations of x-ray, storage, and heat-treatment were applied to Crepis capillaris seeds in order to investigate whether postirradiation sensitivity of seeds to high temperature is altered in the course of storage. The damage was measured in terms of chromosome aberrations in root tips of germinating seeds. Sensitivity of seeds to heat decreases as storage injury progresses. When, however, storage effect is hampered, sensitivity to heat remains unaltered for a period of at least a week. It is suggested that storage and postirradiation heat effects are two alternative ways of magnifying radiation damage, both effects being developed at the expense of the same radiation-induced primary lesions. If one way is retarded the other is not influenced at all with the primary lesions readily responding to high temperature. (auth)

11571 VARIATION IN QUANTITATIVE CHARACTERS IN THE F_2 POPULATION DERIVED FROM UNIRRADIATED AND IRRADIATED HYBRIDS OF RICE. Singh, C. B. (Agricultural Univ., Jabalpur, India). Indian J. Genet. Plant Breed.; 33: No. 3, 369-372(Nov 1973).

The hybrid seeds from japonica × indica crosses of Oryza sativa were irradiated to induce and measure the variability for quantitatively inherited characters and recover types combining good quality of indica and resistance to bacterial blight available in japonica parents. The results suggested that the irradiation of F_1 seeds resulted in significant increase in the range of variation for most of the characters observed in the F_2 generation. However, the means either remained the same or shifted to either direction. The recovery of segregants with good quality coupled with bacterial blight resistance was more in the irradiated than in the non-irradiated F_1 population. (auth)

11572 CYTOGENETICS OF INDUCED SEMISTERILE MUTANTS OF RICE VARIETY TAICHUNG (NATIVE) 1. Vilawan, S.; Siddiq, E. A.; Palanichamy, K.; Singh, V. P. (Indian Agricultural Research Inst., New Delhi). Indian J. Genet. Plant Breed.; 33: No. 3, 380-388(Nov 1973).

Gamma-induced semi-sterile mutants of an indica rice variety T(N)1 were studied for their genetic and cytological behavior. All the semi-sterile lines exhibited either a mono-hybrid or dihybrid segregation ratio and the semisterility behaved as a dominant trait. The meiotic behavior of all the lines including the F_1 hybrids between the parent variety and fertility derivatives was by and large normal except for stray anomalies. It is suggested that the sterility in the present case is genic and is governed by a series of duplicate dominant genes regulated by an inhibitor-anti-inhibitor genetic system. (auth)

11573 IMPROVEMENT OF MUNG BEAN THROUGH INDUCED MUTATIONS. Dahiya, B. S. (Indian Agricultural Research Inst., New Delhi). Indian J. Genet. Plant Breed.; 33: No. 3, 460-468 (Nov 1973).

Two mung varieties were treated with gamma rays. The radiation treatments have been effective in inducing considerable variation for a number of characters of economic value e.g. yield/plant, grain size, number of pods/plant, days to flower, and protein content. The quality of proteins was also changed, some of the M_2 progenies showed a greater range of variation in the content of methionine and tryptophan. The treatment with 70 kR was found to be more effective than 30 kR. But the 30 kR treatment had a stimulating effect on plant growth which was associated with low seed yield. All early maturing mutants were found to be less seed yield productive. The present study has indicated that mutation breeding results in an increase in variation for all quantitatively inherited characters but there was a decrease in the general mean of the irradiated population, with some exceptions. (auth)

11574 INDUCED FLORAL MUTATION IN PHYSALIS IXOCARPA BROT. Mahna, S. K.; Singh, D. (Univ. of Rajasthan, Jaipur, India). Curr. Sci. (India); 44: No. 1, 21-22(5 Jan 1975).

Dry seeds of Physalis ixocarpa were soaked in 0.25, 0.50, 0.75, and 1.0% solutions of dimethyl sulphate, diethyl sulfate, and methyl ethane sulphonate or exposed to 20 to 40 kR of γ rays. The seeds were then sown and an M_1 population obtained. In all, four mutant plants were obtained from 0.50 and 1.0% DES, 0.75% DMS, and 20 kR γ ray treated seeds. The mutations were floral mutations and were very useful for plant breeding studies. (ERB)

11575 RADIOBIOLOGICAL EFFECT OF FAST NEUTRON IRRADIATION ON PEAS. Vasileva, M.; Mekhandzhiev, A. pp 185-191 of Scientific Session of the Institute of Genetics and Plant Breeding - Sofia, 15th and 16th March, 1971. Sofia; Bylgarska Akademiya na Naukite (1973). (In Bulgarian).

From scientific session of Institute of Genetics and Plant Breeding; Sofia, Bulgaria (15 Mar 1973).

Results are reported from a study on radiobiological effects on pea seeds irradiated with fast neutrons in the first horizontal canal of the IRT-200 Atomic Reactor in Sofia. The seeds were treated with the following doses: 10^2, 5×10^2, 10^3, 1.5×10^3, and 2×10^3 rad. Two doses are given: 4.6 and 23.5 rad/min, the reactor having a capacity of 1500 kR. The results obtained show that irradiation with fast neutrons effected with a low power of the flow (4.6 rad/min) suppresses more markedly plant growth, considerably more markedly in the case of higher doses from 5×10^3 rad, expressed in a greater suppression in the growth of the stem and root system, a decrease in the total fresh weight and dry matter content of a single plant and gives rise to chromosomal aberrations of a higher frequency. (auth)

11576 EFFECT OF AMINO ACIDS ON GAMMA-IRRADIATED WHEAT SEEDS. Mathur, J. R.; Bhandari, N. M. (Udaipur Univ. (India). Dept. of Agricultural Botany); Bhandari, K. (Udaipur Univ. (India)). Indian J. Hered.; 2: No. 1, 69-72(Jan 1970).

9 refs., 3 tables.

Post-treatment of amino-acid supplement of 0.05 M asparagine and 0.005 M solution of serine for 4 hours on irradiated wheat seedlings was studied. Results indicate the apparent reversal of the injurious effects of 30 kR gamma irradiation on germination of wheat seedlings and of induced chromosome aberrations. The reversal of chromosome aberrations indicates the repair of the radiation damage by its amino acid, supplementation which might help in directional mutations to control and modify the harmful mutations for the desired characters. Aberral cells (%) recorded at mitotic metaphase and anaphase were 68.5 in untreated 30 kR seeds. Only 12.5% reduction, 26.6%, and 27.7% were observed in 0.05 asparagine, 0.005 serine, and 0.05 molar serine respectively. (INIS)

11577 MUTATIONS THAT ALTER THE TRANSMISSION OF CHLOROPLAST GENES IN CHLAMYDOMONAS. Sager, R.; Ramanis, Z. (City Univ., New York). Proc. Nat. Acad. Sci. U. S. A.; 71: No. 12, 4698-4702(Dec 1974).

Two mutations are described that alter the pattern of inheritance of chloroplast genes in Chlamydomonas. The mutant gene mat-1 linked to the mating type allele mt^- greatly increases the frequency of exceptional zygotes, i.e., zygotes that transmit chloroplast genes from the mt^- (male) parent. In some crosses, 80 to 90% of the zygotes are biparental, transmitting chloroplast genes from both parents. The mat-2 mutation, linked to mt^+, acts to decrease the frequency of exceptional zygotes below the spontaneous level. The mutant effects are discussed in terms of a DNA modification-restirction system, postulated to regulate the transmission of chloroplast DNA in zygotes. (auth)

11578 SOME INDUCED MUTATIONS OF PHYLOGENETIC INTEREST IN LYCOPERSICON. Majid, R. (Indian Agricultural Research Inst., New Delhi). Indian J. Genet. Plant Breed.; 33: No. 3, 285-292(Nov 1973).

Two varieties of Lycopersicon esculentum and one variety of L. peruvianum were treated (seeds) with either uv radiation, γ rays, EMS, or a combination of γ rays and EMS and the various types of mutations induced were isolated in the M_2 and later progenies. This note discusses only those mutations that are of phylogenetic

interest. The participation of other species in the evolution of L. esculentum is discussed on the bases of some of the results. (ERB)

Radiation Effects on Animals

Refer also to abstracts 11661 and 13521.

Man

Refer also to abstracts 11247, 11287, 11659, 13038, 13039, 13443, 13496, 13519, 13520, and 13523.

11579 (BNL-19315) PRODUCTION OF NEGATIVE PIONS AND THEIR INTERACTIONS IN TISSUE. Bond, V. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1973. 4p. Dep. NTIS $4.00.

The properties of pi meson beams are reviewed in relation to the postulated advantages of their use for radiotherapy. These advantages include: good dose distributions, both laterally and in depth; maximum energy deposition in target tissues with minimal energy deposition in normal tissues; and the high LET radiation is confined to the terminal parts of the charged particle beam, resulting in a high effective dose and low oxygen enhancement ratio in target tissues. Methods and facilities under construction for the production of the intense beams of negative pi mesons required for radiotherapy are discussed. (CH)

11580 (BNWL-1870) BIBLIOGRAPHY: EFFECTS OF RADIATIONS ON THE LUNG WITH REFERENCES THROUGH 1972. Sanders, C. L.; Groff, E. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-1830. 53p. Dep. NTIS $5.45.

The bibliography is intended to provide rapid access to the literature on the biological effects of various radiations delivered to the lungs of man and experimental animals. It is intended as a comprehensive survey of the literature from 1947 to 1972. Papers concerned only with dosimetry, radionuclide metabolism, radiography, or the clinical efficacy of radiotherapy are not included. (ERB)

11581 (EUR-5138) ANNUAL REPORT, 1973: PROGRAMME BIOLOGY–HEALTH PROTECTION. (Commission of the European Communities, Brussels (Belgium)). 1974. 833p. (In Several Languages). INIS.

The program includes a Radiation Protection (common program) sector and an "Applications" (supplementary program) sector whose fields of research and objectives can be outlined as follows: 1. Measurement and evaluation of the exposure of man and the various components of the ambient environment to ionizing radiation: – dosimetry, radiation measurement and their interpretation: – study of the transfer and accumulation of radionuclides in man and in the constituents of the environment. 2. Interaction of ionizing radiations with biological systems: – primary effects of radiation: – effects on hereditary material: – short-term effects: – long-term effects. 3. Application of nuclear techniques in certain important sectors of agricultural and medical research. The document presents the progress reports for each project of the contractual program and of the Biology Group Ispra. (INIS)

11582 (LA-UR-74-1530) PIONS AND HEAVY IONS IN RADIOTHERAPY: A BRIEF REVIEW. Raju, M. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 12p. (CONF-741034-2). Dep. NTIS $4.00.

From eleventh international cancer congress; Florence, Italy (20 Oct 1974).

The potential advantages of using high LET radiation sources for neoplasm therapy are discussed. Data are reviewed from studies on the dose distribution, oxygen enhancement ratio, and reactions in tissues of negative pion and charged heavy ion beams. (CH)

11583 (TID-3348) HUMAN RADIATION DOSE STUDIES. A Selected Bibliography. (USAEC Technical Information Center, Oak Ridge, Tenn.). Dec 1974. 88p. Dep. NTIS $7.60.

For Division of Biomedical and Environmental Research, Washington, DC.

Abstracts of 1010 technical reports and journal articles are included in the bibliography. The citations appeared in Nuclear Science Abstracts from January 1962 to June 1973. (ERB)

11584 (UCRL-76109) INVESTIGATIONS OF THE DOSE TO MAN FROM THE WET DEPOSITION OF NUCLEAR AEROSOLS. Knox, J. B.; Molemkamp, C. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. 51p. Dep. NTIS $5.75.

Methods are described that were used for calculations of the potential whole-body external γ dose and dose rate to man and the radiation dose to the thyroid of children due to radioiodine uptake via the forage-cow-milk pathway at various distances downwind from a free airburst of a low yield nuclear device. Wet deposition of radioactive aerosols from the nuclear cloud was assumed. A computer program, ADPIC, was used to calculate the transport and anisotropic diffusion of radioactive aerosols from the formation source during temporal and regional distribution at arbitrary times. Parameters considered included: the effects of noninstantaneous wet deposition, the effects of particle size, wind shear, rainout rate, interaction of the radioactive aerosol cloud with natural convective clouds, precipitation rate, downwind transport time, local convection and vertical air movement, scavenging mechanisms, and the transport of condensation nuclei from cloud air to cloud droplets. Examples of calculations are included. (CH)

11585 RECOMMENDATIONS IN RADIOGRAPHIC PRACTICES, JANUARY 1975. J. Amer. Dent. Ass.; 90: No. 1, 171-172(Jan 1975).

Recommendations concerning protection of the patient during radiographic procedures, protection of office personnel and dentist, modernization of x-ray equipment, use of fast-speed film, and proper darkroom procedures are listed. It is emphasized that the use of x radiation for diagnostic purposes should be made only after careful consideration of both the dental and general health needs of the patient. (HLW)

11586 CHANGES IN VOICE PRODUCTION DURING RADIOTHERAPY FOR LARYNGEAL CANCER. Murry, T.; Bone, R. C.; Von Essen, C. (Veterans Administration Hospital, San Diego, CA). J. Speech Hear. Disord.; 39: No. 2, 194-201(May 1974).

Certain changes in voice production are described that occurred in a patient undergoing radiation therapy for laryngeal carcinoma. The increasing use of radiation as well as conservation surgery for treatment of early-stage laryngeal cancer results in overall improved survival. These techniques also require new directions in vocal rehabilitation. In this study a patient with laryngeal cancer undergoing radiation therapy was studied before, during, and after treatment. Airflow rate, phonational range, most comfortable frequency of phonation, and intraoral air pressure were measured. Eight weeks after the termination of radiation tehrapy, hoarseness persisted, but airflow rate was continuing to drop, the phonational range was increasing, and the most comfortable frequency of phonation appeared stable. Intraoral air pressure for voiced and voiceless consonants was not systematically affected by the changing status of the vocal cords. (auth)

11587 RADIATION DOSE MEASUREMENTS IN MICTURITION CYSTOURETHROGRAPHY. Egeblad, M. (Glostrup Hospital, Copenhagen); Gottlieb, E.; Berg, O. Ann. Radiol.; No. 4, 423-425(May 1974). (In French and English).

Radiation dose measurements in micturition cystourethrography were performed on 30 children (23 females and 7 males). Dose measurements were obtained by thermoluminescence dosimetry. In females the dosimeter was placed rectally and in males it was applied on the scrotum. The mean dose in females showed a correlation with age increasing from 440 to 1515 mR. Among the males increasing doses, correlated to the age of the patients, ranging from 85 to 1025 mR is noted. The gonad dose at times can be very large. To diminish the dose, it is of major importance to decrease use of fluoroscopy and numbers of exposures, especially as micturition cystourethrography often is repeated. (FR)

11588 BLOOD LYMPHOCYTES AFTER RADIATION THERAPY OF MAMMARY CARCINOMA. Blomgren, H.; Glas, U.; Melen, B.; Wasserman, J. (Karolinska Sjukhuset, Stockholm). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 185-200(1974).

Pheripheral blood lymphocytes in mammary carcinoma were examined before and after radiation therapy. The proportion of those binding sheep erythrocytes (thymus-dependent cells) or those having receptors for activated complement (thymus-independent cells) was similar to that of healthy controls. The treatment produced lymphopenia and the proportion of thymus-independent lymphocytes decreased, although that of the thymus-dependent cells increased. The results suggest enhanced mitogen responsiveness with low cell concentrations and impaired reaction of cultures containing those that are higher. (auth)

11589 PITUITARY FUNCTION IN LONG-TERM SURVIVAL AFTER RADIATION THERAPY OF NASOPHARYNGEAL TUMORS. de Schryver, A.; Ljunggren, J. G.; Baaryd, I. (Karolinska Sjukhurset, Stockholm). Acta Radiol.; Ther., Phys., Biol.; 12: No. 6, 497-508(1974).

Twenty-nine patients who had received radiation therapy 10 to 30 years previously for nasopharyngeal tumors were assessed both clinically and by laboratory examinations for a possible late radiation induced impairment of pituitary function. The radiation doses administered (1,700 to 6,800 rad) produced no evidence of pituitary insufficiency nor did any patient need replacement therapy. (auth)

11590 INTERNAL DOSE CALCULATIONS. Kaul, A. (Freie Univ. Berlin (F. R. Germany). Klinikum Steglitz); Roedler, H. D. (Freie Univ. Berlin (F. R. Germany). Zentralinstitut fuer Biochemie und Biophysik). Atomkernenergie; 24: No. 1, 36-42(1974). (In German).

7 figs.; 3 tabs.; 21 refs.

The methods used for internal dose calculations are based on quantities such as geometric factors, effective energies, or absorbed fractions. Starting from the absorbed fraction concept a method for the formally exact calculation of the residual body-target-dose has been developed. The various methods and the limits of their application are discussed. (auth)

11591 EFFECTS OF IRRADIATION ON THE CILIA OF THE SYLVIAN AQUEDUCT. A Scanning Electron Microscopic Investigation. Mecklenburg, C.; Haakansson, C. H. (Univ. of Lund, Sweden). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 232-240 (1974).

Scanning electron microscopy has been used to examine the surface of the aqueduct of Sylvius in a patient irradiated following operation for a malignant temporal glioma. The number of cilia covering the surface were reduced in comparison with those of a nonirradiated patient. The effect upon the circulation of the ventricular fluid is discussed. (auth)

11592 IRRADIATED CEREBELLAR MEDULLOBLASTOMA IN A MONOZYGOTIC TWIN. Growth, Neurology, and Chromosomes 13 Years After Treatment. Bodor, F.; Haakansson, C. H.; Lindgren, M. (Univ. of Lund, Sweden). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 255-265(1974).

A pair of monozygotic twins has been reexamined with regard to growth, neurology, and chromosomal appearance 13 years after one of the twins had been irradiated for cerebellar medulloblastoma. The height and weight were slightly reduced compared with the twin but the curves lie within the limit of a normal population. Almost complete restitution of the patient's neurologic signs has taken place. Chromosome aberrations were found in the lymphocytes; in 1973, 8% of breaks were found instead of 29% in 1960. Dicentrics were not present while the value of this aberration was 14% in 1960. Stable cells occurred in 10% but no new stem lines were discovered. (auth)

11593 BACTERIAL FLORA IN NON-TREATED ORDINARY AND RADIATION DENTAL CARIES. Dachev, B.; Neichev, S. Stomatologiya (Sofia); 55: 281-285(1973). (In Bulgarian).

The authors have studied the character of the bacterial flora in non-treated ordinary and radiation caries in idividuals aged over 20. They established that in caries media and caries profunda the microorganisms met are principally normal inhabitants of the oral cavity. The streprococci, considered as important factor in the origination of the initial caries, were not found in considerable deviations, i.e., increased or decreased in comparison with the other microorganisms. The investigations of the radiation caries do not reveal substantial deviations in the microflora, observed in the ordinary caries. The caries, in existing favorable conditions, was concluded to originate at the same time from a group of microorganisms, most probably not strictly fixed. In the development of the caries, phenomena of bacterial symbiosis and antagonism are manifested, as it can be observed upon normal or pathologically changed mucosa of the oral cavity. (auth)

11594 CRITERIA OF RISK DURING THE USE OF IONIZING RADIATIONS IN MEDICINE. Golikov, V. Ya.; Korenkov, I. P. (Central Inst. of Improvement of Doctors, Moscow). Med. Radiol.; 19: No. 11, 24-26(Nov 1974). (In Russian).

The negative effects of radiation can be divided into threshold effects and non-threshold effects according to the character of the dose dependence. The risk of threshold effect can be correlated with the risk of receiving a dose exceeding the threshold of sensitivity of a critical organ or of all organs. Official standards in the use of radiodiagnostics effectively eliminate this risk. The risk of non-threshold effects is linearly connected with the size of the popu ation dose or the genetically significant dose. This dose was calculated for the population of the Russian Soviet Federated Socialist Republic. The basic criterion for each radiodiagnostic procedure should be predominance of the favorable effects over the negative and the reduction of the negative effects to patients and medical personnel. (JSR)

11595 CONDITION OF MENSTRUAL FUNCTION OF WOMEN WORKING IN ROENTGENODIAGNOSTICAL ROOMS. Muratova, R. M. (Inst. of Industrial Hygiene and Preventive Medicine, Moscow). Med. Radiol.; 19: No. 11, 35-39(Nov 1974). (In Russian).

The menstrual function of 300 women working in medical roentgenodiagnostical rooms and who in the process of work had been subjected to occupational roentgen and γ-irradiation (the main group) and 200 women, medical personnel who had no contact with ionizing radiation (the control group) was analyzed. The observations showed that disorders of the menstrual function in the women of the main group were observed more often than those in the control group. Among the disorders of the menstrual function combined forms of disturbances with the predominance of hypotensive symptoms occurred more often. (auth)

11596 SHORT-DISTANCE X-RAY THERAPY OF EOSINOPHIL GRANULOMAS OF THE BONES OF THE CRANIAL ARCH. Podlyaschuk, E. L.; Rostovtseva, T. F. (Moscow Scientific Research Roentgen-Radiology Inst.). Med. Radiol.; 19: No. 11, 71-74(Nov 1974). (In Russian).

The results of short-distance x-ray therapy of eosinophil granulomas of the bones of the cranial arch, carried out on 13 patients, were reported and analyzed. The results obtained are compared with those reported in the literature for long-distance x-ray therapy. (JSR)

11597 HISTOPATHOLOGIC AND HISTOCHEMICAL CHANGES IN HUMAN SKIN AFTER X-RAY THERAPY IN SINGLE AND FRACTIONATED DOSES. Wozniak, L.; Omulecki, A.; Studencki, E.; Pluta, J. Patol. Pol.; 23: 515-523(1972). (In Polish).

Skin fragments of persons irradiated for carcinoma of the skin were studied histologically and histochemically. Comparison of the effect of fractionated and single doses did not show any significant differences. The histopathologic and histochemical changes in the epidermis and cutis 3 months after irradiation were characterized. (auth)

11598 RADIOGENIC PERIPHERAL NEUROPATHIES FOLLOWING TELECOBALT IRRADIATION IN THE ABDOMINAL CAVITY. Klaua, M. (Martin-Luther Univ., Halle, Ger.). Radiobiol.-Radiother.; 15: No. 4, 459-464(1974). (In German).

Clinic, pathogenesis, differential diagnosis, therapy, and prognosis of radiogenic peripheral neuropathies are discussed by means of 5 casuistic contributions. Avoiding dose peaks by subtile irradiation planning may prevent these complications in most cases. Radiogenic peripheral neuropathy is, however, a rare risk which has to be taken into account even with correctly applied radiation therapy. In the occurrence of neurological early signs the immediate cooperation with an experienced neurologist to elucidate differential diagnosis between tumor progression and radiogenic neuropathy is necessary. (auth)

11599 EFFICACY OF THE CONTINGENT INJURY FUND CONCEPT IN PROVIDING ADEQUATE WORKMEN'S COMPENSATION BENEFITS IN CASES INVOLVING LATENT, NON-SPECIFIC RADIATION INJURY. Kasperski, D. C. Chicago; Northwestern Univ. (1974). 301p. University Microfilms Order No. 74-28,657.

Thesis (Ph. D.).

The present system of Workmen's Compensation has been criticized by some individuals as unworkable when dealing with cases of latent non-specific radiation injury. This is due to the fact that proving causality between past occupational exposure to radiation and subsequent radiation injury has been a difficult, if not impossible task. The Contingent Injury Fund has been proposed as one means by which society can more fairly deal with those radiation workers who develop radiation associated diseases, whether developed by natural incidence or radiation induced. An analysis of the applicability of this concept cannot be attempted, however, until comparative data listing the relative risks are available. This study is an attempt to develop such data for the case of leukemia. A simple model utilizing age and dose specific fractions of the occupationally exposed population has been developed to predict the number of cases of radiation associated leukemia which might be expected to occur among radiation workers. By incorporating best known values of the leukemogenic risk per man-rad-yr, values for the probability of onset of leukemia vs. time after exposure, and allowing for deaths from other causes, the number of occupationally exposed workers in any age group which would be expected to develop the disease in any year can be predicted. With this information, prospective probabilities that a worker with a given exposure history will develop leukemia in any future year can be determined, as can predicted retrospective probabilities that a subsequent case of the disease may have been radiation induced. Calculations indicate that the number of radiation induced cases

of leukemia among radiation workers is expected to continue upwards, with an eightfold increase in the total number of radiogenic leukemias in the next 25 years as compared with the previous 25 years, independent of the value of the leukemogenic risk used. Hence, despite various controls, we will continue to have an increasing burden of radiogenic leukemia in the population, which must be taken into consideration when making benefit/risk calculations. (Diss. Abstr. Int., B)

11600 POSSIBLE GENETIC CONSEQUENCES OF IRRADIATION OF TUMORS IN CHILDHOOD. Lewis, E. B. (California Inst. of Tech., Pasadena, CA). Radiology; 114: No. 1, 147-154(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

Dysgenic and radiation-induced types of genetic risks are evaluated for the progeny of persons who received radiotherapy for tumors during childhood. The dysgenic risks may be quite high for certain types of tumors. The genetic defects of greatest concern following paternal irradiation are likely to be those caused by dominant mutations and unbalanced translocations, whereas chromosomal trisomies may be most important following maternal irradiation. Ways of alleviating these risks are discussed. (auth)

11601 EFFECTS OF RADIATION THERAPY ON BONE GROWTH. Probert, J. C.; Parker, B. R. (Stanford Univ., CA). Radiology; 114: No. 1, 155-162(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

Results of a study of the effects of external irradiation on growing bone are presented together with a review of the literature. Standing and sitting heights of 29 children receiving more than 3,500 rads of megavoltage radiation to the spine and 15 children receiving less than 2,500 rads were compared with those of 15,000 normal children. Retardation of spinal growth was seen in children irradiated during the periods of most active bone growth, i.e., under 6 years of age and during puberty. Correlative radiographic findings similar to those seen with orthovoltage therapy were seen in the high-dose group, but not in the low-dose group. (auth)

11602 RADIOTHERAPY AND CHEMOTHERAPY: SOME PARALLELS AND DIFFERENCES. Hahn, G. M. (Stanford Univ., CA). Radiology; 114: No. 1, 203-212(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

The effects of exposure to ionizing radiations and to various chemotherapeutic agents on the survival of mammalian cells are compared. The relative importance of the cells' sensitivity, age response, proliferative state, and degree of oxygenation and the contributions of kinetic and repair phenomena are examined. Cell killing by high-LET radiations is influenced least by cellular or kinetic factors; thus tumors should show a relatively homogeneous response to this modality, while time-dose relationships should be of least importance. The effectiveness of antimetabolite drug therapy depends critically on the choice of the correct agents and on tailoring drug administration to the kinetics of both normal and malignant tissue. (auth)

11603 CELL CYCLE REDISTRIBUTION AS A FACTOR IN MULTIFRACTION IRRADIATION. Withers, H. R. (Univ. of Texas, Houston). Radiology; 114: No. 1, 199-202(Jan 1975).

From symposium on cell kinetics, models, and cancer treatment at the 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

In the redistribution of cells through the division cycle between radiation dose fractions, the sensitizing effect is greatest when small doses per fraction are used. Since nonproliferating tissues limit the dose in radiotherapy and will not be sensitized by redistribution, the more the dose is fractionated and the lower the dose per fraction, the better. However, regenerative response in the tumor could limit its radiocurability if overall treatment time were protracted. This could be circumvented if two or more fractions were given daily, allowing time for redistribution; the probability of irradiating cycling cells in sensitive phases would then be increased. (auth)

11604 CELL KINETICS, MODELS, AND CANCER TREATMENT: SOME PRINCIPLES FOR THE RADIATION ONCOLOGIST. Hellman, S. (Harvard Medical School, Boston). Radiology; 114: No. 1, 219-223(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

The radiation oncologist must attempt to apply the developments in the laboratory to the clinical situation in a manner that will result in a therapeutic gain. The possible influences of radiation fractionation and protraction, cell renewal and recruitment of normal or tumor tissues, differences in acute and late radiation effects and possible chemotherapy-radiation interactions are all factors that can affect the ultimate result. In order to develop a therapeutic gain, the effect on the tumor must be greater than on the normal tissues. (auth)

11605 CELL POPULATION KINETICS IN RADIATION THERAPY: RELATIONSHIP OF CELLULAR SURVIVING FRACTION TO RBE AND OER. Cohen, L. (Michael Reese Medical Center, Chicago). Radiology; 114: No. 1, 213-218(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

A two-component multitarget model of cellular radiation lethality was used to predict the effects of changing LET and oxygenation. It was assumed that with high-LET radiations there is a greater probability of direct and irreparable events and that hypoxia reduces the number of chemically mediated indirect and reversible events. Cellular surviving fractions, relative biological effectiveness, and oxygen enhancement ratios were computed on this basis and compared with published experimental data. The model and program were then used to generate isoeffect curves for photons and neutrons, oxygenated and anoxic states, and various specific tissues and tumors. (auth)

11606 INTRAOPERATIVE RADIOTHERAPY OF GASTRIC CANCER. Abe, M.; Yabumoto, E.; Takahashi, M.; Tobe, T.; Mori, K. (Kyoto Univ.). Cancer; 34: No. 6, 2034-2041(Dec 1974).

In order to increase the cure rate of gastric cancer, an intraoperative irradiation technique has been developed and applied to 38 patients with this disease. The resectable lesions are treated by surgical procedures, and the remaining malignant remnants sterilized by irradiation with a single massive dose during laparotomy. In this radiotherapy, radiation damage to normal structures is minimized, since normal organs adjacent to the tumor can be shifted from the field so that the lesion may be exposed directly to radiation. The results were analyzed according to stages of the disease and doses delivered. Our clinical results have shown that cure can be expected following intraoperative irradiation of unresectable remnants around major blood vessels, such as the hepatic artery and celiac axis. A single dose of 3500 rad of an electron beam seems to be sufficient as a cancerocidal dose. Indications for intraoperative radiotherapy of gastric cancer are discussed. (auth)

Vertebrates

Refer also to abstracts 11530, 13500, 13502, 13504, 13513, and 13515.

11607 (AD-782493) DELAYED MUTATIONS OF THE STRUCTURE OF CHROMOSOMES IN MONKEY BONE MARROW CELLS AFTER REPEATED PROLONGED IRRADIATION. Kosichenko, L. P. Translated from Genetika; 9: No. 1, 134-142(Jan 1973). 15p. (SAM-TT-R-1178-0973). NTIS $4.00.

A higher percentage of chromosome rearrangements in monkey bone marrow cells is observed four, six, and 8.5 years after prolonged and repeated radiation exposure (2.99 to 4.9 R per day). The basic types of structural chromosome mutations are symmetrical chromosome translocations and pericentric inversions. Homologous chromosomes as well as chromosomes from various groups participate in these exchanges. The presence of monotypic rearrangements in one and the same group of identifiable chromosomes indicates the appearance of new cell clones, marked by the anomalous chromosome. (GRA)

11608 (BNWL-SA-5109) HISTOGENESIS OF FETAL RAT LUNG AND LIVER AFTER X-IRRADIATION IN ORGAN CULTURE AND IN UTERO. Vogt, J. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jun 1974. 215p. Dep. NTIS $13.75.

Thesis. Submitted to Oregon State Univ., Corvallis.

The effects of exposure to 0 or 435 R of x ray on the in vitro and in vivo development of fetal rat lung and liver when irradiated at 13, 15, 17, and 19 days of gestation were compared. In one series of experiments organs were irradiated immediately after explantation and cultured for four hours, one day, or three days. In a parallel series pregnant females were irradiated and the fetal organs were explanted one and three days post-irradiation and cultured four hours. The response of liver explants to culture conditions was variable but the presence of necrosis, fibrinogenesis, and decreased hematopoiesis was consistently noted. The events associated with culturing of the liver tended to mask the effects of radiation on its organogenesis. In the method of culture used, fetal lungs grew and differentiated. There was an initial decrease followed by a resurgence in mitosis between one

and three days post-explantation. In vitro morphogenesis did not keep pace with lungs developing in utero. Specific departures from normal development observed in organ culture included degeneration of the epithelial lining of the bronchial tree; deterioration of blood vessels; pycnosis; especially in the mesenchyme; and an initial decrease in mitosis. In general, radiation accelerated and magnified the changes associated with culturing. In the organ cultures the effects of irradiation were progressive and irreversible for the first three days post-irradiation. Recovery was observed between one and three days post-irradiation, however in lungs remaining in utero. Connective tissue deposition is a normal event associated with morphogenesis and is accelerated by culturing and further accelerated by x-irradiation. Morphologically the connective tissue synthesized does not appear to be the same between the treatment groups. Biochemical and autoradiographic studies of 15-day fetal lung confirm these histological observations. (auth)

11609 ENZYME VARIATIONS PRODUCED IN EPIDERMIS BY SOFT X-RAY COLLIMATED BEAMS. Klein-Szanto, A. J. P.; Cabrini, R. L.; Itoiz, M. E.; Volco, H. E. (Comision Nacional de Energia Atomica, Buenos Aires). Int. J. Radiat. Biol.; 26: No. 3, 285-288(Sep 1974).

An investigation of the effects of localized soft x rays on rat skin revealed changes in epithelial thickness, extension of the epidermal lesion, and variations in the levels of succinic dehydrogenase and glucose-6-phosphate dehydrogenase. Four different collimating slits (ranging from 3 cm by 150 μm to 3 cm by 1200 μm) were used, and in all cases the extension of the epithelial acanthotic lesion was larger than the irradiated area. The radiation induced injury, as measured by epidermal thickness and concentration of oxidative enzyme in the tissue, decreased for the same dose on reduction of the exposed epidermal area. (UK)

11610 SENSITIZATION OF ANOXIC MOUSE TUMORS TO X-RAYS WITH DIAMIDE AND NIFUROXIME. Harris, J. W. (California Univ., San Francisco); Wara, W. M.; Kane, L. J. Int. J. Radiat. Biol.; 26: No. 3, 227-235(Sep 1974).

Injection of diazenedicarboxylic acid-bis-(N,N'-dimethylamide) ("diamide") into ascitic P388 murine lymphocytic leukemia tumors and solid EMT6 carcinomas oxidized their endogenous non-protein sulphydryl content. A non-toxic dose of the compound injected directly into the tumor sensitized anoxic P388 tumors to x-radiation (DMF = 1.82) but had no effect on EMT6 tumors; failure to sensitize the EMT6 may have been due to metabolic consumption of diamide by the solid tumor. Intravenous injection of diamide or of nifuroxime alone had no effect on anoxic EMT6 tumors, nor had a combination of both administered 10 min before irradiation. When the interval between injection of the diamide-nifuroxime solution and irradiation was lengthened to 30 min, however, some sensitization occurred. These results indicate that diamide can sensitize in vivo under some conditions and suggest that better results might be obtained with combinations of radiosensitizing agents than with single compounds. (auth)

11611 SPERMATOGENESIS IN MICE AFTER FRACTIONATED IRRADIATION WITH 200 AND 400 RADS OF X RAYS. Rudnicki, T.; Trojczuk, D. (Zaklad Radiobiologii Instytutu Nauk Fizjologicznych, Poznan, Poland). Nukleonika; 19: No. 10, 933-939 (1974). (In Polish).

The effectiveness of single and fractionated irradiation of testes in mice based on the surviving test of cells of spermatogenetic cycle was compared. It was found that differences in radiobiological response of seminiferous epithelium due to irradiation procedure are revealed only in course of repopulation. There were not evident any differences earlier. It follows, that intensity and dynamics of radiation response initially are due to accumulated dose only, but are independent of number of split doses and time of protraction. The repopulation however, is after fractionated irradiation markedly retarded and less efficient, as compared with single exposure. (auth)

11612 EFFECT OF DOSE FRACTIONATION ON SURVIVING OF OOCYTES IN THE OVARY OF MICE. Rudnicki, T.; Sloniska, B. (Inst. of Radiobiological and Physical Sciences, Poznan, Poland). Nukleonika; 19: No. 10, 941-947(1974). (In Polish).

The mice were irradiated with single and fractionated dose 100 rads, using 2 to 9 split doses in 24 or 96 hours. Qualitative estimation of surviving of oocytes was curried out in 1 to 90 days after irradiation. The number of degenerated oocytes does not depend on the number of split doses or the time of protraction. The final effect of irradiation depends on accumulated dose only. (auth)

11613 PROTECTIVE AND THERAPEUTIC ACTION OF EXOGENIC DNA DURING IRRADIATION WITH FAST NEUTRONS. Chebotarev, E. E.; Ryabova, E. Z.; Indyk, V. M. Kiev; Izdatel'stvo Nauka Dumka (1974). 141p. (In Russian).

Investigation was carried out of the anti-radiation properties of DNA and its depolymerization products during radiation injuries caused by fast neutrons. It was established that DNA increases survival of the animals. The anti-radiation properties do not depend on the degree of polymerization or isology of the preparations, only on the dose of the preparation and schedule of administration. Nitrous bases and desoxymonophosphate complexes exhibit no anti-radiation activity. In the mechanism of anti-radiation effect of DNA an important role is played by the stimulation of immunological reactivity of the organism. (Referativnyi Zh.)

11614 STUDY OF PROTEIN SYNTHESIS IN STYLES OF PETUNIA HYBRIDA L. USING EGG-CELLS OF XENOPUS LEVIS. van der Donk, J. A. W. M. (Katholieke Univ., Nijmegen, Netherlands). Incompat. Newslett.; No. 4, 30-32(Apr 1974).

Plant RNA is injected into uv-irradiated egg-cells of Xenopus levis. After 18 h incubation protein is extracted. The proteins are separated by gel-electrophoresis and gel isoelectric focussing. The radioactivity of each protein is counted. The results show the value of this method for incompatibility research; because in this way it should be possible to synthesize the proteins that are also synthesized in vivo, in purer form and in larger quantities. (NL)

11615 EFFECTS OF VARIOUS TYPES OF IONIZING RADIATION ON BRAIN AND HEART OF WHITE RATS. Khripchenko, I. P.; Fidrik, I. P. Biokhimiya; No. 2, 156-160(1974). (In Russian).

Studies were conducted on cholinesterase activities in subcellular fractions obtained by means of differential centrifugation of 10% tissue homogenates in 0.25 M tris-sucrose buffer (pH 7.4), through the use of high energy inhibitory radiations and electron fluxes with 25 Mev energy particles. Changes in the brain and the heart muscle were diverse; this was related not only to metabolic differences, but also to the nature of the ionizing radiation. (Referativnyi Zh.)

11616 IONIZIRUYUSHCHIYE IZLUCHENIYA I NEYROKHIMIYA. (Ionizing Radiation and Neurochemistry). Reva, A. D. Moscow; Atomizdat (1974). 239p.

An attempt was made to analyze, generalize, and indicate future developments in radiation neurochemistry. The effects of ionizing radiation on the properties and function of brain proteins and the state of certain enzymatic systems are covered. The great radioresistance of brain sulfhydryl groups was demonstrated in the presence of a concurrent sharp decrease of these groups in the blood of irradiated animals. A disucssion is presented of the state of the phospholipid fractions, non-esterified acids, trace elements, and water in the different functional structures of the brain in the norm and after radiation injury of animals. A classification is presented of the biochemical parameters that have been studied which reflect the development of radiation pathology of the brain and of the organism as a whole. A scheme of the biophysical and biochemical aspects of radiation-induced damage to the spinal cord, developed by the author, is presented. (1147 references) (Referativnyi Zh.)

11617 COMBINED EFFECT OF ROENTGEN IRRADIATION AND RADIOSTRONTIUM ON HAEMATOPOIETIC TISSUES AND THE DEVELOPMENT OF LYMPHOMA IN MICE. Jaerplid, B. (Foresvarets Forskningsanstalt, Stockholm). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 217-231(1974).

The effect of fractionated external whole-body irradiation has been compared with the combined effect of such irradiation and of radiation from ^{90}Sr in respect to changes in the hematopoietic tissue and the development of lymphoma in mice. The investigation has shown that the regeneration seen in hematopoietic tissues after roentgen irradiation is delayed if the external irradiation is supplemented by ^{90}Sr treatment. The delayed bone marrow regeneration leads, inter alia, to incomplete regeneration and increased incidence of lymphomas in the thymus. Strontium-induced nonthymic lymphomas increase in incidence if ^{90}Sr treatment is supplemented by small doses of external irradiation. (auth)

11618 LONGEVITY PARAMETERS. Dunjic, A. (Univ., Louvain, Belgium). Eulep Newslett.; No. 6, 2-24(6 May 1974).

From training meeting of the Committee for Laboratory Animals Standardization; Louvain, Belgium (13 May 1973).

In gerontological and radiobiological reports the most widely quoted longevity parameters for mice and rats are the mean lifespan and/or the median lifespan. Both the mean and the median values are the central point estimates of a simple distribution. In contrast to mean-standard deviation statistics, the

median-quartile statistics pertain to non-parametric methods, the chief utility of which is in describing large samples from abnormal distributions (Snedecor 1956). As an estimate of variation, the interquartile interval Q_3-Q_1 includes half the observed values. The above longevity parameters are arbitrarily determined either from birth (normal sample) or from the beginning of the experimental treatment (irradiated animals). The current time-units used are either days, weeks, or months. In controlled animal experiments and accurate lifespan measurements usually the time of death is known to the nearest day. For graphic presentation of survival or mortality data the week- and month-intervals are convenient. (For facility of transformation to other time-units of "lunar months" (periods of four weeks) are perhaps preferable). However important and useful the mean and the median lifespan may be, it must be recognized that these lifespan characteristics represent single specific points derived from more complete response-time data. (BE)

11619 LATE NON-NEOPLASTIC PATHOLOGY IN IRRADIATED ANIMALS. Shewell, J. (Saint Bartholomew's Hospital, London). Eulep Newslett.; No. 6, 33-35(6 May 1974).

From training meeting of the Committee for Laboratory Animals Standardization; Louvain, Belgium (13 May 1973).

The laboratory animals most commonly used in late effect studies are still, unfortunately, the small rodents, and most of the following remarks will be limited to mice and rats. One point to remember is that the pathology of the laboratory mouse is wide, with a large range of infectious conditions that may be encountered. The rat has a far more limited range of inherent diseases, but since CRD of rats is so wide-spread very few investigators would risk a long-term study in rats without an efficient barrier-maintained state. If, failing all else, long-term experiments on rats have to be undertaken in a conventional animal colony, the best compromise is to obtain CD rats and put them directly into a room to which no other rat user has access. One can divide long term radiation experiments into two categories: a) whole-body exposure with morbidity and mortality studies; b) partial-body exposure with reference to late change in a particular organ. This type of experiment is most informative when combined with functional studies. For either type, it is essential to have a knowledge of the background pathology and ageing changes in the different strains used. (BE)

11620 IMPORTANCE OF GENETIC FACTORS IN LATE EFFECT STUDIES. Leonard, A. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Eulep Newslett.; No. 6, 44-52(6 May 1974).

From training meeting of the Committee for Laboratory Animals Standardization; Louvain, Belgium (13 May 1973).

The choice of the animals utilized for long term studies after irradiation must take into account their genetic characteristics. These characteristics determine largely the differences in lifespan between the strains as well as the great variations observed with respect to the effect of an identical exposure to radiation. The influence of those genetic factors will be reviewed shortly by analyzing for different strains of mice the lifespan of male and female mice maintained under conventional or specific pathogen conditions; the life shortening induced by similar exposure to ionizing radiations; the litter size components; and the mutation rate resulting from an exposure of mature spermatozoa to x-radiation. (BE)

11621 GASTRIC EMPTYING AND SMALL INTESTINAL PROPULSION IN MICE FOLLOWING IRRADIATION OF THE ABDOMEN. Frankendal, B. (Umeaa Univ., Sweden). Acta Radiol., Ther., Phys., Biol.; 12: No. 6, 529-540(1974).

A test meal containing a radioactive isotope ($Na_2{}^{51}CrO_4$) was deposited in the stomach and its distribution in the alimentary tract measured post mortem in mice treated by different irradiation schedules. Irradiation with 250 rad daily up to a total dose of 4,000 rad had no demonstrable effect on gastric emptying. A daily dose of 500 rad up to a total dose of 1,000 and 2,000 rad inhibited gastric emptying and accelerated propulsion of the contents of the small intestine. (auth)

11622 EFFECTS OF X-RADIATION ON GROWTH AND FUNCTION OF THE REPAIR BLASTEMA (GRANULATION TISSUE). III. Measurements of Pharmacodynamic Activity in Vitro. van den Brenk, H. A. S.; Stone, M. (Saint Thomas' Hospital, London). Int. J. Radiat. Biol.; 26: No. 3, 237-249 (Sep 1974).

The development of contractility during growth of granulation tissue (GT) in unirradiated and irradiated skin of the rat has been studied. The Selye pouch method was used to grow GT, and the in vitro technique of Majno et al. (1971, Science, N. Y., 73, 548) to measure pharmacodynamic responses to various drugs. In particular, the reactions of the tissue to 5-hydroxytryptamine and other inflammatory autacoids and to colchicine and related spindle poisons were studied. Irradiation delayed the onset of contractility and its development by reducing growth of GT; it did not affect affinity or intrinsic activity of receptors to agonists which cause contraction of this tissue, but tended to increase the strength of contraction. These observations are discussed in relation to the roles of microtubules and microfilaments in the control of cell tone and of the cellular mechanisms underlying wound contraction. (auth)

11623 EXAMINATION OF COMBINED INJURIES. P. 19. The Content of Corticoids in the Adrenal Glands of Mice Exposed to Whole-Body Irradiation Combined with Open Skin Wounds. Messerschmidt, O. (Laboratorium fuer Experimentelle Radiologie, Neuherberg/Muenchen (F. R. Germany)); Maurer, G. (Technische Univ. Muenchen (F. R. Germany). Chirurgische Klinik und Poliklinik); Sedlmeier, H. Strahlentherapie; 148: No. 1, 87-94(Jul 1974). (In German).

4 figs.; 16 refs.

NMRI-type mice were exposed to a total-body irradiation of 500 R, the skin of their backs was wounded or both injuries were applied to them. Fluorometrical determination of the corticosteroids produced in their suprarenal glands after the irradiation showed a two-phase increase of the values that had their peaks 2 hours and 2 days after the radiation impact. A cutaneous lesion brought about caused a minor increase of hormones with the increase taking place at about the same times as those observed after the irradiation. As for combined injuries, the determining factor was whether the wound was inflicted before or after the irradiation: A wound inflicted 2 days post irradiation caused a continuous steroid increase lasting throughout the examinations after having reached a minimum value 3 days post operation; a wound inflicted 10 minutes after the irradiation caused a marked increase of hormones after 2 days which 8 days later reached its peak and then declined. On the other hand, when inflicting the wound before applying the irradiation, a precocious adrenocortical reaction could be observed that subsided until the 3rd day after the irradiation. (auth)

11624 NEOPLASTIC CHANGES IN IRRADIATED KIDNEY. Maldague, P. (Saint Bartholomew's Hospital, London). Eulep Newslett.; No. 6, 36-43(6 May 1974).

From training meeting of the Committee for Laboratory Animals Standardization; Louvain, Belgium (13 May 1973).

The appearance of neoplasms in irradiated animals can have a causal relationship dependent on several factors, some of which will be reviewed. One may assume that each tissue can undergo neoplastic transformation if it has been irradiated, but the induced neoplastic changes are not always easily detected if they are not expressed as tumor. One of the basic requirements is that the incidence of spontaneous tumors in the target tissue is very low, or, totally absent. Therefore a constant observation of non-irradiated controls is indispensable throughout the complete period of experiments. Since a high incidence of spontaneous hepatomas precludes the rational use of mice in liver radiocarcinogenesis, this was one of the main reasons of taking the kidney as the target tissue in our experiments. (auth)

11625 PECULIARITIES OF CHRONIC ACTION OF X RADIATION ON THE FUNCTIONAL CONDITION OF THE KIDNEYS UNDER CONDITIONS OF HIGH EXTERNAL TEMPERATURE AND INSULATION. Muratkhodzhaev, N. K.; Myasnik, B. N. (Scientific Research Inst. of Oncology and Radiology, Tashkent). Med. Radiol.; 19: No. 11, 68-71(Nov 1974). (In Russian).

Rabbits received daily x-radiation doses of 25 R and were maintained in conditions of high levels of solar radiation and high external temperature. The data obtained led to the conclusion that chronic irradiation depresses all phases of activity of the kidneys. High temperature of the external medium and insulation affects the response of the kidneys to chronic irradiation in unique ways. Preliminary solar-thermal over-exposure before irradiation increases the resistance of the kidneys to irradiation. Single post-irradiation solar-thermal over-exposure partially reduces the degree of severity of the radiation injury to the kidneys (improves the vascularization and secretion activity of the tubules and somewhat normalizes the glomerular filtration), but causes clear uremia, which, from the data of radioisotopic renology, is connected with the lag in the excretion function. The reduction of the sharpness of the polyuria in all cases of solar-thermal over-exposure can be explained by the water-conservation effects in response to overheating of the organism. (JSR)

11626 TRACYLOL, ε-AMINOCAPROIC ACID, AND DIMETHYLSULFOXIDE FOR PROPHYLAXIS AGAINST RADIATION

EFFECTS ON THE SKIN. Gaponyuk, P. Ya.; Uklonskaya, L. I.; Arzamastsev, E. V. (Scientific Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 11, 66-68(Nov 1974). (In Russian).

Tracylol, ϵ-aminocaproic acid, and dimethylsulfoxide during prophylactic injection decreased the skin injuries of rabbits after x irradiation at doses of 15,000 and 25,000 rad. Dimethylsulfoxide was the most active. The radioprotective effect of dimethylsulfoxide was amplified by its combination with tracylol. (tr-auth)

11627 ASSESSMENT OF RADIOPROTECTION ACTION OF S-ADKHNON. Vygodskaya, A. L.; Komarova, L. E.; Yarmonenko, S. P. (Inst. of Experimental Clinical Oncology, Moscow). Med. Radiol.; 19: No. 11, 64-65(Nov 1974). (In Russian).

The radioprotective effect of S-adkhnon (adrenochrome monoguanyl hydrazone methane sulfate) was tested on mice exposed to 850, 950, and 1050 R of ^{137}Cs γ radiation and rats exposed to 900 R, administered in both fractionated and single doses. No protective effect was observed for either animal. (JSR)

11628 PECULIARITIES OF DESCENDANTS OF IRRADIATED BIOLOGICAL OBJECTS. Vorobtsova, I. E. (Leningrad Scientific Research Inst. of Radiation Hygiene). Med. Radiol.; 19: No. 11, 76-83(Nov 1974).

A critical review is presented of recent studies on the descendants of irradiated humans, mammals, and drosophila. (JSR)

11629 MEDULLARY HEMOPOIESIS AND GLUCOCORTICOID-GLYCEMIC HOMEOSTASIS IN ACUTE RADIATION SICKNESS. Barklaya, A. I. Med. Radiol.; 19: No. 11, 39-43(Nov 1974). (In Russian).

In experiments on irradiated white mice (750 rad), an attempt was made to determine pathogenesis of the inhibition effect of postradiation hypercorticonism on medullary hemopoiesis in the light of glucocorticoid influence on carbohydrate metabolism. Restoration of medullary hemopoiesis was in reverse dependence on the postradiation dynamics of glycemia, which was determined by glucocorticoid secretion and gluconeogenesis intensified by radiation. It was assumed, that at the basis of glucocorticoid mechanism of reduction of hemopoietic tissue activity there lies a blocking influence of hypercorticonism on delivery of glucose into the cells and on the glycolysis. In this connection a directed regulation of carbohydrate metabolism was conducted by means of suppression of the adrenal gland hypersecretion with dianabol or by introduction of concurrent insulin. The rate of restoration of medullary hemopoiesis increased as a result of definite normalization of glucocorticoid-glycemic homeostasis. (auth)

11630 CYTOGENETIC ANALYSIS OF BONE MARROW PROTECTION WITH MEXAMINE IN DIFFERENT IRRADIATION DOSES. Voitkevich, N. D.; Palyga, G. F.; Yarmonenko, S. P. (Scientific Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 11, 12-17(Nov 1974). (In Russian).

It was shown that in case of a one-time general β-irradiation ^{60}Co of white mongrel mice-males in the range within 150 to 450 rad under the influence of previously administered mexamine the number of injured metaphases of the bone marrow cells significantly decreased and the degree of the rational affection of chromosomes dropped. The contra-radiation effect of mexamine depends upon the amount of the protector introduced. Cytogenetic investigation of the bone marrow conducted during the first mitosis after irradiation (in 12 to 24 hrs) is recommended as a model for the assessment of the protective influence of the contra-radiation agents. (auth)

11631 INCREASE OF THE EFFICACY OF RADIOTHERAPY OF TUMORS WITH DNA SYNTHESIS INHIBITOR OXYUREA. Pelevina, I. I.; Afanas'ev, G. G. (Inst. of Chemical Physics, Moscow). Med. Radiol.; 19: No. 11, 7-12(Nov 1974). (In Russian).

The effect of the DNA synthesis inhibitor oxyurea on the efficiency of the x-radiotherapy of NKL tumors in mice was studied. The mice were injected with doses of 100 to 1000 mg/kg of oxyurea at various times before irradiation at a dose of 1000 R. The inhibiting effect of oxyurea was first studied and it was shown that this compound completely inhibits the synthesis of DNA, but the effect appears to be short-term. In the study of the combined effects of oxyurea and x radiation, it was shown that the increase of the effects of irradiation is insignificant for single injection of oxyurea and single exposure for all chemical doses used and all time intervals studied. With triple injection of oxyurea and triple irradiation at 1000 R a significant inhibition of the growth of the tumor was observed. These results are discussed in relation to the equation of regression of tumors and the doubling time calculated by this equation. (JSR)

11632 RADIOPROTECTIVE EFFICACY OF CYSTAMINE ACCORDING TO THE CRITERIA OF ABERRANT MITOSIS IN THE BONE MARROW IN GENERAL AND LOCAL IRRADIATION. Vladimirov, V. G.; Pyatovskaya, N. N. (Military Medical Academy, Leningrad). Med. Radiol.; 19: No. 11, 3-6(Nov 1974). (In Russian).

In studies on mice, rats, and dogs it was shown that the radioprotective effect of cystamine, evaluated by test of aberrant mitoses in irradiated bone marrow, is almost the same in local and whole-body irradiation. The dose reduction factor of cystamine at optimum radioprotective doses (150 mg/kg for mice and 50 mg/kg for dogs) is 1.43 for mice irradiated with a local dose of 700 rad with x rays and 1.35 for whole-body irradiation. In dogs irradiated with a dose of 300 rad the values are 1.45 and 1.50 respectively. In rats subjected to irradiation doses of 600 rad and receiving cystamine in quantities of 60 mg/kg, the rate of aberrant mitoses is reduced to the same extent in whole-body and local irradiation (12 to 13%). The data obtained led to the conclusion that the radioprotective effect of cystamine, established by tests of chromosome aberrations in cells of locally irradiated bone marrow, can be extrapolated with success to cases of whole-body irradiation. (tr-auth)

11633 STUDY OF A THERAPEUTIC EFFECT OF EPSILON-AMINOCAPROIC ACID IN ACUTE RADIATION SICKNESS IN DOGS. Luzanova, O. V.; Rogacheva, S. A. Med. Radiol.; 19: No. 11, 18-23(Nov 1974).

ϵ-aminocaproic acid was administered to dogs who had been subjected to γ-irradiation in a dose of 600r during the latent period and at the acme of the disease. The introduction of this acid did not decrease the possibility of the development of the hemorrhagic syndrome and did not influence the clinical course and outcome of acute radiation sickness. (auth)

11634 HISTOCHEMICAL AND BIOCHEMICAL ALTERATIONS IN RABBIT CORNEAS AFTER X IRRADIATION. Cejkova, J.; Simkova, M.; Bolkova, A. (Karlova Universita, Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). Cesk. Oftalmol.; 29: No. 5, 331-336(Sep 1973). (In Czech).

Rabbit corneas were irradiated with x rays. In the first out of three experimental groups the corneas were irradiated with a single dose of 4,000 R, the corneas in the second group with a dose of 8,000 R (twice 4,000 R at a time interval of one week), and in the third group with 12,000 R in three doses of 4,000 R with two intervals of one week. The rabbits of all experimental groups were sacrificed after 6 weeks and the corneas were examined histologically, histochemically for acid mucopolysaccharides, and biochemically by the determination of hexosamines and uronic acid. In the corneas, no serious histological alterations were found. The x rays seriously affected the mucopolysaccharide metabolism of the cornea early after irradiation. The amount of acid mucopolysaccharides significantly decreased and the corneal stroma was hydrated depending on the degree of irradiation. (auth)

11635 RADIOPROTECTIVE EFFECT OF AET AND SEROTONIN ON GROWING RATS EXPOSED TO FRACTIONAL SMALL-DOSE X IRRADIATION. Nikolov, I. T.; Baev, I. A. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 19-26 (1972).

A study was made on the radioprotective properties of aminoethylisothiouranium bromide (AET) and of hydroxytryptamine-creatine 5-sulfate (serotonin) during partial daily irradiation of young rats with a 27.5 R dose of x rays over a period of 10 days. The weight of the growing rats from the second up to the fifth month was taken as a criterion for determining the radioprotective properties. The results showed that AET has radioprotective properties during fractionated irradiation (with a dose below the lethal dose) of young growing organisms. Under similar conditions, serotonin does not manifest radioprotective properties. (tr-auth)

11636 EFFECT OF BETA RADIATION ON HEALING OF CORNEAL WOUNDS. Vrabec, J. (Karlova Universita, Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi). Cesk. Oftalmol.; 29: No. 5, 327-330(Sep 1973). (In Czech).

In an experiment on rabbits using impregnation with silver after Jaboner, the effect of beta radiation on the healing of corneal wounds was studied. In the upper third of the limbal circumference a subtotal keratotomy was performed, its central part was irradiated by a contact beta applicator with an effective area of 6 mm in diameter. The rabbits were first exposed on the fifth day after incision at a time of fully developed cellular activity. The total doses were 2500, 5000, 7500, and 10,000 rad. A marked

slowing down of healing in the irradiated part of the incision was found. The character of the alterations and the result of the irradiation at a time of full cellular proliferative activity agrees with literary descriptions of the healing of corneal incisions in previously irradiated corneas. The study shows that the slowing down effect of beta radiation does not depend on the time interval in relation to the incision, but only on the dose of radiation. (auth)

11637 EFFECT OF GAMMA RADIATION ON CHICKEN LIVER CATHEPTIC ACTIVITY AND RELEASE OF LYSOSOMAL CATHEPSIN D. Ali, M.; Richards, J. F. (Univ. of British Columbia, Vancouver). J. Food Sci.; 40: No. 1, 47-49(1975).

Chicken liver slices were subjected to 0.05 to 1.00 Mrad doses of gamma radiation. Total and free catheptic activities were determined immediately after irradiation. Total catheptic activity was higher and free catheptic activity was lower in irradiated samples than in nonirradiated controls. Isolated lysosomal suspensions were irradiated at doses 0.1 to 1.00 Mrad. Total catheptic activity was significantly decreased by irradiation. Radiation resulted in a decrease in absorbance (540 nm) of lysosomal suspensions incubated at 37°C which was paralleled by a pronounced increase in free catheptic activity. Rate of release of catheptic enzymes from lysosomes was considerably slower when incubated at 4°C compared to 37°C. (auth)

11638 INCREASE OF RADIOPROTECTIVE POTENCY OF 5-METHOXYTRYPTAMINE BY MEANS OF CALCIUM. Pospisil, M.; Netikova, J. (Inst. of Biophysics, Brno). Radiobiol.-Radiother.; 15: No. 4, 521-524(1974).

Possibility of the increase of radioprotective potency of mexamine (s. c. injection applied 5 min before irradiation) by means of calcium (i. p. injection of $CaCl_2$, 3.21 g%, 30 min before irradiation) was tested in mice of C57Bl strain. Application of $CaCl_2$ significantly increases protective action of mexamine. Increase of mexamine effect by means of calcium may be demonstrated by the data of spleen weights, ^{59}Fe uptake in the spleen and bone marrow, amount of endogenous spleen colonies, increase of leucocyte peripheral levels in postirradiation repair phase, and even by increased survival of animals protected by lower doses of mexamine. (auth)

11639 IMPROVED EDUCATION OF STUDENTS AND MEDICAL SPECIALIST CANDIDATES IN RADIOBIOLOGY BY MODEL TESTS FOR DEMONSTRATION OF RADIATION INJURIES. Neumeister, K.; Paul, R.; Jahns, J. (Karl-Marx-Univ., Leipzig). Radiobiol.-Radiother.; 15: No. 4, 525-535(1974).

The step from knowledge to cognition is especially well facilitated by model examples illustrating the matter by concentration to essential and general validity. For the radiobiological part of radiology lecture a model test on rats was elaborated for the demonstration of radiation sickness and of the dependence of severity and course of this disease and of its symptoms on the height of the active radiation dose. In dependence on the available time and on the volume of the educational material two test variants were elaborated. In variant 1 the animals were exposed to a whole-body irradiation of 100, 200, and so on or 1000 R and the clinical changes and laboratory values were followed for four weeks. In variant 2 the irradiation was performed with 300 and 1000 R only. The observation ranged for 14 days only. The following details can be demonstrated by this experiment: Symptomatology and clinical course of acute radiation sickness; Course of radiation responses of the hematopoietic system; Course of radiation responses of the gastrointestinal tract; and Derivation of diagnostic criteria. (auth)

11640 CHANGES IN THE CONTENTS OF SOME RAT SERUM PROTEINS UNDER PATHOLOGIC CONDITIONS. II. The Influence of Some Further Noxious Factors in Comparison with the Effect of Ionizing Radiation. Simsa, J.; Mraz, J. (Purkyne Medical Research Inst., Hradec Kralove, Czech.). Radiobiol.-Radiother.; 15: No. 4, 509-519(1974).

Concentrations of albumin, $alpha_1$-lipoprotein, ceruloplasmin, $alpha_2$-globulin(6), haptoglobin, hemopexin, beta-globulin(8), transferrin, and gamma globulin were studied by means of quantitative immunoelectrophoresis and radial immunodiffusion in rats under different pathologic conditions. The influence of burns, intravenous injection of endotoxin, infection, peroral injection of mustard gas (bis-/2-chloroethyl/sulfide), subcutaneous injection of turpentine oil, has been investigated. Changes in the concentrations of the mentioned serum proteins were also studied, for comparison, in a group of controls and in a group of rats with whole-body irradiation with 750 R. It has been ascertained that the changes of serum proteins in rats observed after whole-body irradiation are in principle similar to the changes induced by the above mentioned factors. (auth)

11641 CHANGES IN THE CONTENTS OF SOME RAT SERUM PROTEINS UNDER PATHOLOGIC CONDITIONS. I. Effect of Ionizing Radiation. Simsa, J.; Mraz, J. (Purkyne Medical Research Inst., Hradec Kralove, Czech.). Radiobiol.-Radiother.; 15: No. 4, 499-507(1974).

Concentrations of albumin, $alpha_1$-lipoprotein, ceruloplasmin, $alpha_2$-globulin, haptoglobin, hemopexin, beta-globulin, transferrin and gamma globulin were studied by method of quantitative immunoelectrophoresis and radial immunodiffusion in whole-body irradiated male and female rats. The animals were exposed to 300, 650, 750, 900, and 1200 R. With albumin and $alpha_1$-lipoprotein, a statistically significant decrease of the concentration was observed after higher doses. This fact was important for prognosis (it signalized the early death of the animal). $Alpha_2$-globulin, ceruloplasmin, haptoglobin, hemopexin, and beta-globulin disclosed an increase of the concentration. The level of transferrin in the serum was only influenced to a small extent. With gamma globulin, a decrease was observed after higher exposures, lower doses induced in some cases an increase of its content in the serum. (auth)

11642 CHROMOSOMAL CHANGES IN BONE-MARROW OF DSUNGARIC HAMSTERS FOLLOWING A SINGLE WHOLE-BODY X IRRADIATION. Grigoroff, L. A. (Staatliche Amt fuer Atomischerheit und Strahlenschutz, Berlin). Radiobiol.-Radiother.; 15: No. 4, 493-498(1974). (In German).

The chromosomal changes as well as the mitotic activity in bone-marrow were studied in dsungaric hamsters following a single whole-body irradiation. The examinations were made 1, 3, and 24 hours after irradiation of the animals with 12.5, 25, 50, 100, 200, and 300 R. A sigmoid effect relation between dose and number of cells with aberrations could be observed having a linear course in the range of 50 to 200 R 1 and 3 hours after irradiation. With increasing time after irradiation a reduction of all chromosomal damages is to be found. (auth)

11643 OXYGEN CONSUMPTION VALUES DURING IRRADIATION AS AN INDEX OF THE RADIOPROTECTIVE ACTION OF 5-METHOXYTRYPTAMINE. Misustova, J.; Novak, L.; Hosek, B.; Kautska, J. (Inst. of Biophysics, Brno). Radiobiol.-Radiother.; 15: No. 4, 487-491(1974).

The relationship was studied between the individual response of oxygen consumption on the administration of 5-methoxytryptomine (25 mg/kg body weight) and the protective action of this dose at the exposure of 900 R. Results showed that there are significant differences in average values of oxygen consumption during irradiation between surviving and dying animals in the sense that the group of surviving animals responded to the application of mexamine by a more profound decrease. The analysis of the distribution of individual values of oxygen consumption at 10-minute intervals during irradiation revealed significant differences between frequencies of surviving and dying animals occurring in individual categories of oxygen consumption. The time-course of oxygen consumption after the application of mexamine thus reflects to a certain extent the radioprotective effectiveness of the applied dose of protector. (auth)

11644 SOME INFLUENCES OF ELECTRON RADIATION ON THE TESTES OF XENOPUS LAEVIS (DAUDIN). van der Linde, T. C. de K. (University of the Orange Free State, Bloemfontein (South Africa)). Jul 1973. 177p. (In Afrikaans). INIS.

Copies available from Atomic Energy Board, Pelindaba, Pretoria (South Africa).

The testes of Xenopus laevis are elongated organs, which are round or dorsoventrally flattened in cross section. Structurally the testes consist of the following: tunica albuginea, interstitial tissue, seminiferous tubules filled with the different spermatogenic cells, non-spermatogenic cells viz. Sertoli and follicle cells and collecting tubules. The testes of Xenopus laevis are described microscopically. Pre-spermatogenic cells were observed in a few seminiferous tubules. Multiple testes were found in five of the experimental animals. Rudimentary oviducts were observed in three of the Xenopus laevis males used in this study. The testes of the experimental animals were irradiated with 7 MeV electrons, each animal receiving a dose of 3000 rads. Variations in radiation damage and in radiation sensitivity of the structural units of the testes were observed. The difference in radiation sensitivity of the different testis components were examined and can be arranged in the following order: primary spermatogonia, secondary spermatogonia, primary spermatocytes, secondary spermatocytes, spermatids, collecting tubules, vasa efferentia, spermatozoa, interstitial tissue, Sertoli cells, follicle cells. The Wolffian ducts and vasa efferentia showed approximately the same sensitivity to radiation. The blood vessels appear normal after irradiation, but the blood cells have been damaged extensively. In the spermatogenic cells in both the normal and irradiated testes showed quantitative increases and decreases over a period of 64 days. (INIS)

11645 EFFECT OF OZONE INHALATION ON THE FREQUENCY OF CHROMOSOME ABERRATIONS OBSERVED IN

IRRADIATED CHINESE HAMSTERS. Zelac, R. E. Gainesville, FL; Univ. of Florida (1970). 128p. University Microfilms Order No. 74-27,378.

Thesis (Ph. D.).

Chromosome aberrations produced in circulating blood lymphocytes were the indicator of biological damage. Effects in these cells would be a qualitative indicator of similar damage to other cells throughout the test animal. Exposure-adjusted break frequencies served as the quantitative measure of effect. Adult female Chinese hamsters, Cricetulus griseus (2n = 22), were exposed, in groups of four, to x-radiation (118 keV effective, 70 cm FSD, 230 rad dose), to ozone (0.2 ppm, UV generated), or to both simultaneously. All exposures were of 5 hr duration. There were two groups per treatment and two additional groups, one serving as a control and the other exposed to 330 rad. A total of 50 animals were utilized in the investigation, including 18 in preliminary experiments. Blood samples (0.2 ml) were obtained by orbital bleeding. Following plasma removal, the cells were cultured in an enriched media for 3 days at 37°C in a humidified 5 percent CO_2 environment with pokeweed as the mitogen (lymphocyte transformation and division stimulant). Division was arrested in metaphase with colchicine. Following hypotonic KCl treatment to swell the cells, they were fixed with a 3:1 methanol-acetic acid solution, transferred to a slide, and rapidly dried by ignition. The slides were stained with Giemsa and scanned using bright-field microscopy. Spreads were photographed on 35 mm film and projected onto a screen for analysis (with subsequent microscope rechecks of spreads exhibiting breaks). The aberrations scored were deletions, dicentrics, and rings. Radiation resulted in an exposure-adjusted break frequency of 5.51×10^{-4} (breaks/cell-rad) for cells withdrawn 2 weeks after exposure. This value appeared reasonable in comparison to available information on in vivo exposure of human lymphocytes and Chinese hamster bone marrow cells. Successful lymphocyte cultures could not be obtained until 2 weeks had elapsed. Break frequency appeared to vary linearly with dose in the region 230-330 rad. Ozone resulted in an exposure-adjusted break frequency of 1.67×10^{-3} [breaks/cell-(ppm-min)], agreeing well with the value expected from in vitro exposure of human cells. There was no apparent decrease in break frequency with time for 2 weeks' post-treatment. Animals exposed to the two agents simultaneously exhibited > 70 percent of the total number of breaks anticipated assuming additive actions. Expected contributions from ozone and from radiation were nearly equal. There was, however, approximately an 18 percent (15 percent) chance that all the breaks observed resulted from the radiation (ozone) exposure alone. (Diss. Abstr. Int., B)

11646 MICROVASCULATURE OF C3H/Bi MOUSE MAMMARY TUMORS AFTER X-IRRADIATION. Hilmas, D. E.; Gillette, E. L. (Colorado State Univ., Fort Collins). Radiat. Res.; 61: No. 1, 128-143(Jan 1975).

X-irradiation of C3H/Bi mammary carcinomas with single exposures appeared to improve the colloidal-carbon filling of the existing microvasculature and cause a change in their morphologic appearance, with disappearance of some large-diameter sinusoidal vessels. Although the change was transient, the over-all microvascular picture after radiation treatment was similar to that of smaller nonirradiated tumors. Based on these quantitative estimates, a transient capability for improved oxygen status conceivably existed for cells of the mouse carcinoma at various times after single-dose irradiation (particularly after 500 or 1500 R). A large single exposure of 4500 R, however, appeared to cause extensive damage to the microvasculature, as evidenced by a segmented pattern of vessel filling. To take full advantage of any reoxygenation in this tumor, the optimum time for a second exposure dose after 500 R might be 24 hr, while after 1500 R it might be 2–3 days. (auth)

11647 INFLUENCE OF ADRENALECTOMY ON RADIATION HYPERTENSION AND NEPHROSCLEROSIS. Lurie, A. G.; Casarett, G. W. (Rochester Univ., NY). Radiat. Res.; 61: No. 1, 80-99(Jan 1975).

Adrenalectomized and nonadrenalectomized rats were sham-irradiated or received either single exposures of 500 or 2000 R x-radiation bilaterally to temporarily exteriorized kidneys or 500 R partial-body (whole-body except for shielded temporarily exteriorized kidneys). These rats were studied for systolic blood pressure and killed for gross pathology and renal histopathology at 5 or 10 wk following treatment. Hypertension and arteriolonephrosclerosis were induced by all doses and modes of irradiation in adrenalectomized and nonadrenalectomized rats in the main experiment. Elevation of mean systolic blood pressure in adrenalectomized irradiated rats was substantially greater than in nonadrenalectomized irradiated rats. The highest mean systolic pressure was 227 mm Hg in adrenalectomized partial-body irradiated rats with shielded kidneys (500 R). Arteriolonephrosclerosis was greater in severity in adrenalectomized irradiated rats than in nonadrenalectomized irradiated rats at comparable times after exposure. Hypertension was initially observed just prior to or concomitant with the earliest detectable arteriolonephrosclerotic changes. The data indicate that the removal of the adrenals and the adrenal hormone production permits, or acts synergistically with, the radiation to markedly hasten and increase the severity of radiation-induced hypertension and nephrosclerosis. Possible mechanisms are discussed. (auth)

11648 MODIFICATION OF THE RESPONSE OF MOUSE SKIN TO X-IRRADIATION BY BLEOMYCIN TREATMENT. Leith, J. T.; Lewinsky, B. S.; Schilling, W. A. (Univ. of California, Berkeley). Radiat. Res.; 61: No. 1, 100-109(Jan 1975).

Skin reactions occurring on the legs of mice after 230 kV x-irradiation were used to investigate the combined effects of x-irradiation and bleomycin. Bleomycin was given daily for 5 days (5 mg/kg/day), either preceding or following graded single doses of x rays. Skin reactions occurring after combined treatment were compared to skin reactions produced by x-irradiation alone. Both bleomycin treatment schemes yielded average 1 to 30 day postirradiation skin reactions greater than skin reactions seen after x-irradiation alone. Dose-response curves for the combined treatments were parallel to the x-irradiation alone treatment, but were displaced upwards. The responses obtained in the two bleomycin schemes were not significantly different. The dose modifying effect of the bleomycin treatments ranged from 1.5 at low levels of effect to 1.2 at higher levels of effect. It is concluded that the combined effects of bleomycin and x-irradiation were additive. (auth)

11649 RADIOSENSITIVITY OF THE ARENICOLOUS LIZARD, UMA NOTATA. Kleinbergs-Krisans, S.; Catlett, R. H. (San Diego State Univ., CA). Radiat. Res.; 61: No. 1, 110-117(Jan 1975).

The radiobiological sensitivity of the arenicolous lizard, Uma notata, was studied. A therapy x-ray unit, operated at maximum output was employed as the source of radiation. The $LD_{50/30}$ and $LD_{50/60}$ were determined and the hematopoietic response after an $LD_{50/30}$ exposure was investigated. The $LD_{50/30}$ exposure for Uma was calculated to be 24,000 R, and the mean survival time was 28 days. The $LD_{50/60}$ was calculated to be 3000 R and the mean survival time 58 days. During the 30-day experimental period after exposure, a significant decrease (95% confidence limits) was observed in spleen weight and granulocyte number. Hematocrits remained within control levels. (auth)

Invertebrates

Refer also to abstract 13508.

11650 (AEC-TR-7592, pp 28-32) RADIORESISTANCE OF SOME PLANKTON AND BENTHOS SPECIES OF CRUSTACEA. Dolgushina, Z. K.; Onanko, E. I. Dec 1974. Translated from pp 50-56 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The data on experimental studies with radiation doses from 0.2 to 12 kR indicate a high radioresistance of plankton and benthos organisms. These radiation doses do not cause any marked somatic shifts in the spawners and their offsprings. The study on the effects of ionizing radiation on the fecundity of the studied species of organisms revealed differences in their radiosensitivity. It was established that small radiation doses had a stimulating effect on some species of Cladocera and Ostracoda. (auth)

11651 (AEC-TR-7592, pp 57-60) STUDY OF RADIOSENSITIVITY OF NATURAL POPULATIONS OF FRESHWATER MOLLUSK LIMNAEA STAGNALIS L. Famelis, S. A. (Inst. of Plant and Animal Ecology, Moscow). Dec 1974. Translated from pp 89-94 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Embryos from populations of a mesotropho-dystrophic lake have a much higher radiosensitivity than embryos from populations of an oligotropho-mesotrophic lake (on the average by 31 percent), while their survival rates in the control are the same. Radiosensitivity of their embryos is subject to seasonal changes. (auth)

11652 (COO-2001-10) GENETIC EFFECTS OF LOW X-RAY DOSES. Progress Report, August 16, 1973–September 15, 1974. Abrahamson, S.; Meyer, H. U. (Wisconsin Univ., Madison (USA)). 1974. Contract AT(11-1)-2001. 16p. Dep. NTIS $4.00.

Results are summarized from studies of the dose kinetics for the induction of recessive sex-linked lethals in immature germ cells of Drosophila following single exposures to x radiation at

doses of 20 to 500 R. The progeny of x-irradiated females were analyzed for sex-linked lethal mutations in relation to the dose received. (CH)

11653 (IAEA-R-950-F) USE OF LABELLED PESTICIDES FOR COMPARATIVE STUDIES OF THE RECOVERY OF PESTICIDE RESIDUES BY CONVENTIONAL OR RECOMMENDED SOLVENT EXTRACTION TECHNIQUES APPLIED TO SPIKED AND AGED CEREAL SAMPLES. Part of a Coordinated Programme. Final Report, 1 January 1971–31 December 1971. Hoodless, R. A.; Jackson, F. J.; Tarrant, K. R.; Griffiths, B. E. (International Atomic Energy Agency, Vienna (Austria)). Jan 1974. 9p. INIS.

^{32}P-labelled dichlorvos (0,0-dimethyl-2,2 dichlorovinyl phosphate) was used for studying the efficiency of solvent extraction of dichlorvos residues resulting from using dichlorvos as a cereal grain fumigant. It was indicated that in samples aged at room temperature a negligible fraction of the total residue behaved as unchanged dichlorvos which could be extracted after 15 days. The residue behaved as unextractable phosphorylated protein and would not be determined by conventional extraction and gas chromatographic analysis. Storage of samples at −17°C, greatly slowed down reaction between the ^{32}P-labeled residue and grain constituents so that up to 20 days most of the total residue behaved as unchanged dichlorvos and could be extracted with methanol. Thus, wheat grain samples taken for the determination of residual dichlorvos should be stored at −17°C and analyses completed within 21 days. (auth)

11654 RNA SYNTHESIS AND POLYRIBOSOME METABOLISM IN X-IRRADIATED SYNCHRONIZED TETRAHYMENA. Paul, I. J.; Zimmerman, A. M. (Univ. of Toronto). Radiat. Res.; 61: No. 1, 144-157(Jan 1975).

MAK column chromatography of RNA extracted from synchronized Tetrahymena after x-irradiation revealed age-dependent depressions in the cellular content of the various species of RNA and in the synthesis of Q_{β}, Q_{β}, and TD RNA. Sucrose density-gradient analysis of polyribosomes extracted from irradiated cells revealed age-dependent depressions of cellular polyribosomes, of newly synthesized messenger RNA, and of nascent polypeptide synthesis. The results are interpreted as supporting the hypothesis that the radiation-induced delay of cell division may be due primarily to the radiation-induced depression of division-essential messenger RNA synthesis. (auth)

Radionuclide Effects (Internal Source)

Refer also to abstracts 11247, 11583, 11584, 11590, and 11594.

Man

11655 (AD-782720) TECHNETIUM-99m PYROPHOSPHATE: COMPARISON OF ED50 FOR TETANY AND ACIDOSIS WITH ACUTE LD500. Stevenson, J. S.; Eckelman, W. C.; Sobocinski, P. Z.; Barron, E. L.; Levin, S. G. (Armed Forces Radiobiology Research Inst., Bethesda, Md. (USA)). Apr 1974. 24p. (AFRRI-SR-74-5). NTIS $3.00.

Two severe biochemical disturbances appear to explain the acute clinical manifestations of toxic doses of ^{99m}Tc pyrophosphate when administered as a single intravenous bolus. These are reduction in the serum concentration of both total and ionized calcium and metabolic acidosis. The electrocardiogram and chemical analysis revealed that the hypocalcemic effect occurs at a much lower dosage than for the LD50. Polyphosphate was found to be more toxic by the LD50 analysis than pyrophosphate. It is emphasized that the hypocalcemic toxic effects should be the determining factor in deciding what dose of ^{99m}Tc Sn-pyrophosphate should be administered for bone scanning. At the dose level employed (.32 mg/kg), a safety factor of 40 to 1 was used with regard to the first signs of hypocalcemia by electrocardiographic measurements (i.e., 2 mg/kg). On this basis an injection of no more than 1 mg/kg is recommended to maintain a safety factor of around 10 to 1. (GRA)

11656 (AED-CONF-73-570-002) RADIATION DOSIMETRY AFTER ENDOLYMPHATIC RADIONUCLIDE THERAPY. Pfannenstiel, P. (Deutsche Klinik fuer Diagnostik, Wiesbaden (F. R. Germany). Sektion Nuklearmedizin). 1973 10p. (In German). INIS.

From 10th workshop of the Deutsche Klinik fuer Diagnostik together with the International Society of Lymphology; Wiesbaden, Germany (1 Dec 1973).

Radiation dosimetry after endolymphatic therapy with ^{32}P and ^{131}I-labelled oily contrast medium was performed in 32 patients. The total dose applied averaged 1 mCi ^{131}I and 2.9 mCi ^{32}P, respectively. By measuring the changes in concentration of the radioactivity in different parts of the body during the first week, the radiation doses were calculated approximately from the rate of decomposition of the radionuclide in the different parts of the body and from the volume of the tissue. Assuming homogeneous distribution in the pelvic and paraortal lymph nodes, the dosage is massive, averaging 100,000 rads. A rather low percentage of radioactive labelled contrast medium is received by the lungs and consequently low radiation doses may occur here. However, serious limitations have to be considered in the reported measurements due to the marked inhomogeneity of dose distribution in lymph nodes and lungs. (auth)

11657 (BNWL-SA-5057) CAN PARTICLE-SIZE ANALYSIS HELP OVERCOME EXCESSIVE CONSERVATISM IN ASSESSMENTS OF POPULATION DOSES? Waite, D. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 6p. (CONF-741018-8). Dep. NTIS $4.00.

From 8th midyear topical symposium of the Health Physics Society; Knoxville, Tennessee, USA (21 Oct 1974).

The importance, benefits, needs, practices, and methods of generating and utilizing environmental particle size distribution data for the development of permissible exposure standards for the general population and personnel in work areas are discussed, with emphasis on health hazard control of radioactive aerosol inhalation. It is pointed out that the importance of environmental particle-size distribution analysis is influenced by recent data which confirm that often certain nuclides are associated with unique environmental particle-size distributions. Specific contaminant concentrations in the respirable fraction may be under or overestimated by as much as two orders of magnitude if contaminant concentrations are assumed to be invariant with particle size. Also known is that the respirable fraction of particulate contaminant concentration is a function of environmental conditions and residence time in the environment. (CH)

11658 (LA-UR-74-1826) CURRENT STATUS OF INFORMATION OBTAINED FROM PLUTONIUM CONTAMINATED PEOPLE. Richmond, C. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 41p. (CONF-740715-18). Dep. NTIS $5.25.

From 5th international radiation research congress meeting; Seattle, Washington, USA (14 Jul 1974).

There has been no recorded incidence of cancer or serious biological damage in man resulting from occupational exposures to internally deposited Pu. However, we must consider the relatively short time since exposure in some cases. Because of industrial accidents in the early Manhattan Project a number of individuals have been exposed to Pu. Some have maintained multiples of the maximum permissible body burden (MPBB) for almost three decades. Although the exact levels of contamination are uncertain, it is clear that this body of information represents a valuable resource for study. Data have been reported for specific groups (Manhattan Project workers), and other studies are accruing data for future use as the populations age. Another source of particularly valuable information is on 18 people who received tracer doses of Pu during the late 1940's, which provided the basis of the human excretion equations derived by Langham. The injected levels ranged from about 0.25 to about 5.8 microcuries and, in one case, was retained for 21 years. Other information exists in the form of virtually the entire world's population which has accumulated Pu, although somewhat inefficiently, from detonations of nuclear weapons and burn-up of one thermoelectric generator (^{238}Pu) in the atmosphere. Information obtained from these and other sources is summarized. (auth)

11659 (ORNL-4996) BIOLOGICAL DOSE AND RADIOLOGICAL ACTIVITY FROM NUCLEAR REACTOR OR NUCLEAR WEAPON FISSION PRODUCTS. Chester, R. O. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 91p. Dep. NTIS $5.45.

A computer code, YIELDS, is described that performs rapid, accurate calculation of dose and activity from the fission products in a nuclear reactor core or from a nuclear weapon. For example, if a dispersal model is assumed, calculations can be made of contaminated area, dose from inhaled or ingested fission products to each part of a biological system, or dose from external fission products, from a dispersed reactor core, or nuclear weapon fallout. Individual β and γ ray energies for each isotope are included, permitting detailed calculation of biological dose or other functions of these energies vs time. The calculation method facilitates the handling of complicated radiological decay chains coupled with multisection biological systems. The option of sorting the output by isotopes or chemical species is available. (auth)

11660 (ORNL-TM-4730) ESTIMATED RADIATION DOSES FROM INGESTION OF TRITIUM-CONTAINING CONSUMER PROD-

UCTS MADE WITH HYDROCARBONS FROM NUCLEARLY STIMULATED NATURAL GAS WELLS. Barton, C. J.; Reynolds, S. A. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 30p. Dep. NTIS $4.50.

Commercial-scale use of nuclear explosives to increase production of natural gas could result in the introduction of hydrocarbons containing tritium into petrochemical feedstocks. Most petrochemical products are not for human consumption, but this report considers radiation doses that could be received from ingestion of several products hypothetically produced from natural gas containing 1 pCi of tritium/cm^3 of gas. One of the highest estimated whole-body doses (0.9 millirem/year) was from ingestion of sufficient ethyl alcohol to maintain a concentration of 0.15%, the intoxication level, in the body water throughout the year. A slightly higher dose (1.0 millirem/year) was estimated for ingestion of a synthetic protein supplement. Estimated whole-body doses from ingestion of other products ranged from 0.5 millirem/year for an individual eating one lb/day of a hydrogenated fat or oil product to 0.005 millirem/year for a person taking eight aspirin tablets per day. It is concluded that ingestion of products made from tritiated hydrocarbons resulting from use of nuclearly-stimulated natural gas could conceivably be a significant exposure pathway for some individuals, but it seems unlikely to become the most important pathway. (auth)

11661 DUST EVALUATION STUDIES DURING MINING AND MILLING OF URANIUM. Saha, S. C.; Ghosh, D. K.; Somayaji, K. S. (Bhabha Atomic Research Centre, Bombay). Ind. Safety Chron.; 4: No. 4, 53-57(Apr 1973).

The mining of uranium ore is not much different from operations in other metalliferous mines. Uranium ore contains a significant percentage of free silica. Hence persons engaged in mining and milling of uranium ore are subjected to exposures of dust containing relatively high percentage of free silica. The health hazards associated with airborne dust, methods of evaluation of concentrations of dust in air and the values obtained for the same over the last six years, during different operations and at different levels of the mine and at the various stages of milling are briefly described. Job exposures of identified critical groups are also evaluated and it is predicted that the dust exposures are not expected to give any significant clinical or pathological changes in the exposed groups of workers. (auth)

11662 HYGIENIC ASSESSMENT OF THE EFFECTIVENESS OF MEANS OF DECONTAMINATING SKIN SURFACES CONTAMINATED WITH ^{237}Np. Khodyreva, M. A.; Simakov, A. V.; Andreeva, N. A.; Sit'ko, R. Ya. Gig. Sanit.; No. 11, 31-35(Nov 1974). (In Russian).

In case of skin contamination with ^{237}Np (independent of the type of contamination) the most effective were compounds "Zaschita" and paste 11^{o}. The finding was, that in case of dry contact contamination of the skin with ^{237}Np the effectiveness of decontamination was 3 times higher than it was at the time of presence on the skin of a solution of ^{237}Np nitrate. An augmentation of the time of contact from 1 to 5 hours decreased the effectiveness of the laundry soap twice. In the use of special compounds (paste 11^{o} and "Zaschita") the effectiveness of the isotope removal from the skin surface did not depend on the time of its previous contact with the skin, since ^{237}Np was both removed from the skin surface and washed out from the orifices of hair follicles and the outer part of the excretory ducts of skin. (auth)

11663 DOSE ASSESSMENT INHALATION OF RADIOACTIVE NUCLEAR FISSION PRODUCTS IN RADIOMETRY OF THE LUNGS. Malykhin, V. M.; Belle, Yu. S.; Moroz, G. L. Med. Radiol.; 19: No. 11, 43-49(Nov 1974). (In Russian).

A method is suggested of determination of the dose of products of instantaneous radioactive fission for the lungs in inhalation entry on the basis of the express method of the lungs radiometry with the aid of a portable scintillation detector. Nomograms are given for establishing the dose of a single or continuous entry. Characteristics of the detector dose graduation and measurable levels of fission products in the body are discussed. (auth)

11664 USE OF RESOLVING RADIOACTIVE PREPARATIONS IN EXPERIMENTAL ONCOLOGY. Dedenkov, A. N.; Dedov, V. I. (Scientific Research Inst. of Medical Radiology, Moscow). Med. Radiol.; 19: No. 11, 30-35(Nov 1974). (In Russian).

The morphological changes in tumor tissue occurring at different distances from the resolving radioactive preparation in the form of a film containing ^{90}Y were described. The morphological changes observed were compared with the absorbed dose. It was established that with use of resolving radioactive films with a surface activity of 100 μCi/cm^2 the zone of dependable sterilization of the tumor does not exceed 4 to 5 mm. It was assumed that use of these preparations can not only effectively influence small (up to 4 to 5 mm) tumors and residual tumor cells in the operation wound, but also lead to a minimum injury to the surrounding healthy tissue. The latter is especially important in cases where the tumor is located close to vitally important or functionally necessary organs and tissues. (tr-auth)

11665 FREQUENCY OF DIFFERENT HISTOLOGIC TYPES OF BRONCHOGENIC CARCINOMA AS RELATED TO RADIATION EXPOSURE. Archer, V. E. (National Inst. for Occupational Safety and Health, Salt Lake City); Saccomanno, G.; Jones, J. H. Cancer; 34: No. 6, 2056-2060(Dec 1974).

Epidermoid, small cell undifferentiated, and adenomatous types of bronchogenic carcinoma were all shown to be increased among uranium miners. This was done by use of calculations of expected numbers for each of the major histologic types. The predominance of the small cell undifferentiated histologic types, however, was so great that it appeared to be the only type whose frequency was elevated in earlier, relative distribution studies. The same three histologic types have been shown to be elevated among cigarette smokers, but with different relative frequencies. These findings are consistent with Kreyberg's hypothesis that small cell undifferentiated and epidermoid carcinomas of the lung are closely related, and are the principal types whose frequency is affected by inhaled carcinogens, even though adenocarcinomas are also increased to some extent. (auth)

11666 FREQUENCY OF TUMOR INDUCTION IN A THOROTRAST KIDNEY. Verhaak, R. L. O. M.; Harmsen, A. E.; van Unnik, A. J. M. (St. Ignatius Hospital, Breda, Netherlands). Cancer; 34: No. 6, 2031-2068(Dec 1974).

A group of 10 patients with Thorotrast kidney who underwent pyelography with Thorotrast in the early 1930s was studied. An invasive carcinoma of the renal pelvis developed in 4 of them, diagnosed 21, 27, 32, and 34 years after Thorotrast pyelography. In 1 patient we found a carcinoma in situ of the renal pelvis after a latency of 35 years, and in 3 patients (35, 35, and 37 years after pyelography) the epithelium of the renal pelvis was dysplastic and metaplastic. Only in 2 patients of this group were no epithelial abnormalities found after 24 and 25 years. (auth)

Animals

Refer also to abstracts 11650, 11651, and 11692.

11667 (AEC-TR-7592, pp 2-12) EFFECT OF IONIZING RADIATION ON THE BIOLOGICAL CONDITION OF FISH. Shekhanova, I. A.; Voronina, E. A.; Klyashtorin, L. B.; Pechkurenkov, V. L.; Yarzhombek, A. A. Dec 1974. Translated from pp 7-24 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

It is shown that the assessment of the effect of dissolved radionuclides on developing fish eggs based on the number of dead or abnormal embryos is not a reliable method. It was established that the count of distorted chromosomes in embryos is a more sensitive test for radiation effects. In fact, the number of aberrant anaphases in the embryos of Misgurnus fossilis increased when the ^{90}Sr, ^{239}Pu, and ^{137}Cs concentration in the solution was over 10^{-3} curie/liter. At the same radionuclide content, a tendency toward increased metabolic rates in fish was revealed. When fishes were kept for a long time in solutions with a ^{90}Sr + ^{90}Y concentration of 10^{-6} curie/liter, this resulted in partial sterilization of males and reduction in the number of offsprings. (auth)

11668 (AEC-TR-7592, pp 13-18) CHRONIC EFFECT OF ^{144}Ce AND ^{137}Cs RADIONUCLIDES DISSOLVED IN WATER ON THE EMBRYONIC DEVELOPMENT OF ATLANTIC SALMON. Kasatkina, S. V.; Kosheleva, V. V.; Migalovskaya, V. N.; Migalovskii, I. P.; Oganesyan, S. A. Dec 1974. Translated from pp 25-35 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The results of studies on chronic action of ^{144}Ce and ^{137}Cs on individual systems, organs and tissues of embryos and larvae of Atlantic salmon in the process of their development and differentiation are presented. It was established that, with respect to many indexes, eggs developing in water contaminated by ^{144}Ce or ^{137}Cs are more sensitive to the presence of ^{144}Ce. This is, probably, explained by the fact that eggs accumulate approximately 100 times less ^{137}Cs than ^{144}Ce, as well as by the different intensity of the stream of β-particles passing through the embryo. (auth)

11669 (AEC-TR-7592, pp 19-24) ACCUMULATION AND EFFECT OF ^{90}Sr AND ^{90}Y DISSOLVED IN WATER ON EMBRYONIC DEVELOPMENT OF SOME FISH SPECIES IN THE CASPIAN SEA. Dokholyan, V. K.; Kostrov, B. P.; Bityutskaya, G. S. Dec 1974. Translated from pp 36-44 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

It was established that ^{90}Y accumulates during embryogenesis several times more intensively than ^{90}Sr, and that the bulk of ^{90}Y accumulates on the egg membrane, while some of ^{90}Sr (depending on the fish species) passes through the membrane into the perivitelline fluid and accumulates in the embryo tissues. The accumulation of isotopes by larvae is more intensive than by eggs. Incubation of eggs of various fish species in radioactive solutions with concentrations lower than n. 10^{-6} curie/liter did not cause any increase in the death rate. In a solution on n. 10^{-6} curie/liter, there was a statistically certain increase in the death rate of the embryos in comparison with the control group. At low concentrations (n. 10^{-10} curie/liter), the gaseous interchange of the embryos was stimulated, and at high concentrations (n. 10^{-6} curie/liter) it was inhibited. (auth)

11670 (AEC-TR-7592, pp 25-27) EXPERIMENTAL STUDY OF THE INJURING EFFECT OF MIXTURES OF FRAGMENTARY RADIONUCLIDES IN THE EMBRYONIC DEVELOPMENT OF FRESHWATER FISH DEPENDING ON THE ASSIMILATED DOSE. Mazheva, N. I.; Sukal'skaya, S. Ya. (Scientific Research Inst. of Radiation Hygiene, Leningrad). Dec 1974. Translated from pp 45-49 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Studies are described on injuring effects of chronic irradiation on fish eggs within a wide range of doses created by β-radiation of mixtures of nuclear fission products and radionuclides of ^{131}Y, $^{140}Ba + {}^{140}La$, $^{106}Ru + {}^{106}Rh$ introduced in water once in concentrations from 3×10^{-9} to 3×10^{-3} curie/liter. The data characterizing the mortality of eggs depending on the dose received during the entire incubation period up to the moment of hatching make it possible to conclude that doses of 500 rad and up increase the amount of dead eggs. For such integral indexes as average lifetime of eggs, shortening of the development time, and increase in the number of abnormal larvae, the dependence of the power-function type on the dose absorbed by the eggs during incubation up to the moment of hatching, starting with a dose of 100 rad, was established. (auth)

11671 (AEC-TR-7592, pp 50-56) RADIORESISTANCE OF EGGS OF SOME INDUSTRIAL FISH. Telysheva, I. G.; Shulyakovskii, Yu. A. Dec 1974. Translated from pp 78-88 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Studies on the influence of radioactive irradiation on the development of eggs of some fish species of the Atlantic Basin revealed that doses of ionizing radiation of the order of 1 rad did not have any pathogenic effect. The development of eggs and larvae in water contaminated with ^{90}Sr and ^{137}Cs in concentrations reaching 10^{-5} curie/liter^{-1} progressed just as well as the development of eggs under optimal conditions. The effect of ionizing radiation on fish embryos in doses not exceeding 100 rad decreased their death rate to a certain degree. (auth)

11672 (AEC-TR-7592, pp 61-64) SPONTANEOUS CHROMOSOME CHANGEABILITY OF PELAGIC ANIMALS IN ATLANTIC AND PACIFIC OCEANS. Tsytsugina, V. G. (Inst. of Biology of South Seas, Kiev). Dec 1974. Translated from pp 95-101 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Studies on the natural chromosomal changeability of oceanic animals showed that the frequency of nuclear disturbances and variability of this index are higher for the Pacific organisms. This fact, evidently, indicates the effects of external mutagenic factors on their mutation process and different individual sensitivity to these effects. (auth)

11673 (BNL-18896) GENETIC AND HEMOPOIETIC EFFECTS OF LONG TERM TRITIATED WATER INGESTION. Carsten, A. L.; Cronkite, E. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 9p. (CONF-741120-1). Dep. NTIS $4.00.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

Randomly inbred mice were maintained on HTO (3 μCi/ml) for extended periods. First generation animals on HTO from weaning (four weeks of age) were evaluated for changes in growth pattern and bone marrow integrity. Second generation animals on HTO were evaluated for breeding efficiency and dominant lethal mutation rate. In the genetic studies, comparisons were made between four experimental groups. The results of these studies indicate that continuous ingestion of HTO at a concentration of 3 μCi/ml by mice results in: a reduction in the number of viable embryos present in the female at late pregnancy from matings when either or both parents have been on HTO; an increase in the number of early post implantation deaths when both parents are on HTO; and reduction in bone marrow stem cell content after 28 weeks or longer on HTO. No apparent effect on breeding efficiency (% females pregnant) or body weight was observed. (CH)

11674 (BNWL-SA-5045) LYMPHOCYTOPENIA INDUCED IN BEAGLE DOGS BY INHALATION OF $^{239}PuO_2$. Ragan, H. A.; Park, J. F.; Olson, R. J.; Buschbom, R. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 23p. (CONF-740930-8). Dep. NTIS $4.25.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

Beagle dogs about 18 months of age were exposed by inhalation to $^{239}PuO_2$ aerosols resulting in an initial alveolar dose of 0.003 to 6 μCi. Deep lung deposition of ^{239}Pu was estimated by whole-body counting at 14 and 30 days postexposure and peripheral blood samples were collected every three months during the 34 month observation time. The only consistent effect of $^{239}PuO_2$ inhalation on the hematologic parameters was on the lymphocyte population. A significant lymphocytopenia developed in the four highest exposure groups which correlated with the initial lung burden. The pathogenesis of this lymphocytopenia is discussed in relationship to the temporal dose distribution and dose-response curves. (CH)

11675 (BNWL-SA-5056) EFFECTS OF TRANSURANICS ON PULMONARY LYMPH NODE OF RODENTS. Sanders, C. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 19p. (CONF-740930-10). Dep. NTIS $4.00.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

Pulmonary lymph nodes have been suggested as the critical tissue for retention of insoluble, inhaled transuranic compounds. About 800 rats were given from 0.2 nCi to 3600 nCi of $^{238}PuO_2$ or $^{239}PuO_2$ by inhalation, intratracheal instillation, intrapleural injection, or intraperitoneal injection. From about 1 to 10% of deposited Pu was translocated to pulmonary lymph nodes, the amount depending on the time after deposition and the route of administration; $^{238}PuO_2$ was cleared from pulmonary lymph nodes faster than $^{239}PuO_2$ due to the greater in vivo solubility of $^{238}PuO_2$. No primary tumors of pulmonary lymph nodes were observed, indicating that this tissue was not the critical tissue for carcinogenic induction. (auth)

11676 (BNWL-SA-5119) PLUTONIUM-INDUCED LYMPH-ADENITIS IN BEAGLES. Dagle, G. E.; Park, J. F. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 14p. (CONF-740930-9). Dep. NTIS $4.00.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

The histopathological effects of ^{239}Pu α particles on lymph nodes of beagles are described. Results are summarized from studies of the popliteal lymph nodes after $^{239}PuO_2$ was implanted in the hind paws and of tracheobronchial lymph nodes in beagles that died from radioinduced pneumonitis after inhalation of $^{239}PuO_2$ aerosols. The radiation dose to the popliteal lymph nodes was calculated to be between 0.2 to 2.9 μCi and that to the tracheobronchial lymph nodes 2.0 to 27 μCi. The 5.1 MeV α particles emitted by ^{239}Pu penetrate soft tissues approximately 50 microns. The pathological changes in the lymph nodes were similar after inhalation and subcutaneous exposure. Plutonium was found to accumulate in lymph nodes as a result of phagocytosis of the particles, indicating that the macrophages are involved in Pu translocation. Necrosis was an early and persistant change in Pu-contaminated lymph nodes and inflammatory changes and fibrotic proliferation developed after several weeks, followed by the development of scar tissue. Cavitation also occurred as a direct result of radioinduced breakdown of collagen fibers or failure of collagen synthesis. It was concluded that the sequestration of Pu particles in scar tissue of lymph nodes probably reduces the potential for radioinduced damage to surrounding cells. (CH)

11677 (COO-3167-108) BIOLOGICAL EFFECTS OF RADIATION FROM SIMULATED ^{238}Pu POWER SOURCES IN DOGS. Kallfelz, F. A.; Comar, C. L.; Craig, P. H.; Casarett, A. P. (New York State Veterinary Coll., Ithaca (USA). Dept. of Physical Biology). 1972. Contract AT(11-1)-3167. 8p. Dep. NTIS $4.00.

Biological effects of radiation from simulated ^{238}Pu power sources were studied using the Labrador Retriever as the experimental animal. The simulated sources consist of a combination of ^{252}Cf (to provide the neutron component of a 30 watt ^{238}Pu source) and $^{90}Sr-{}^{90}Y$ Bremsstrahlung (to provide the additional photon flux needed). Sources are placed in the center of a spherical stainless steel capsule (333 ml volume) and the capsule implanted in the left paralumbar fossa between the internal and external abdominal oblique muscles. Sources have been implanted

which deliver 1, 5, 15, or 70 times the radiation dose expected from a 30 watt ^{238}Pu power source, and dose rates to various organs from these sources have been measured and calculated. A total of forty-eight dogs have been implanted to date. The maximum total accumulated dose in a single dog has been 37,000 Rad at 1 cm from the surface of the implantation capsule. Clinical evaluation of implanted dogs revealed no alterations in any of the parameters measured, except for a decreased total circulating lymphocyte count and a cessation of sperm production in the 70X animals. These preliminary results indicate that mammalian organisms may be able to tolerate the radiation dose incident with the use of ^{238}Pu power sources for major cardiac assist devices or artificial hearts. (auth)

11678 EFFECT OF SMALL DOSES OF IONIZING RADIATION ON MECHANICALLY DAMAGED BONE TISSUE IN RABBITS. Kochanski, J. W. Pol. Tyg. Lek.; 29: No. 5, 197-198(4 Feb 1974). (In Polish).

Studies on rabbits showed that breathing of air containing 1 nCi of ^{222}Rn per liter increased the rate of removal of bone substance. With 5 nCi/liter, the rate of growth is slowed. (MG)

11679 CHANGES IN THE INTEGUMENT OF ANIMALS FOLLOWING GENERAL β-IRRADIATION WITH ^{133}Xe AND ^{85}Kr. Bechik, I. I.; Zhiltsov, I. F.; Lemesh, G. A.; Makarov, V. I.; Mirtov, A. V. Med. Radiol.; 19: No. 11, 26-30(Nov 1974). (In Russian).

Experiments made on white rats showed that β-irradiation with ^{133}Xe in a dose of 2300 to 2700 rad mainly affected concha auricle skin which led to the formation of a scar or complete healing. In animals who had been irradiated with ^{85}Kr in doses of 14 500 to 20 600 rad, infection of the integument and mucous membranes of the nose and eyes developed causing their complete destruction. (auth)

11680 QUANTITY AND DURATION OF GENETIC DAMAGE IN MICE CAUSED BY RADIOACTIVE ISOTOPES INCORPORATED DURING FETAL DEVELOPMENT. Baev, I. A. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 9-18 (1972).

Pregnant mice ($CC_{57}W$) were injected intraperitoneally with 60 μCi/mouse of ^{89}Sr, ^{131}I, or ^{32}P on the 12th day after impregnation. From the three groups of animals irradiated in the second half of their intra-uterine development, by free interbreeding, were developed three irradiated subgroups (irradiated males and females). The effect of the three radionuclides was studied on each of the irradiated populations. Significant genetic damage was shown with phenotypic phenomena, expressed by a decrease in the offspring in the F_1 generation and, in several subsequent generations, an increased frequency of nonproductive matings and decreased hereditary adaptation expressed by an increase in the number of still-born, infant deaths, and underweight offspring. In the first generation of the irradiated population there were observed peculiar biological effects, depending on the physical characteristics and metabolism of the radioisotopes used, with greater genetic damage due to ^{32}P. In the F_2 and F_3 the overall damage was almost the same in the three irradiated populations. After three generations the phenotypic phenomena were eliminated. (tr-auth)

11681 CYTOGENETIC STUDIES OF MEIOTIC CHROMOSOMES (DIAKINESIS-METAPHASE I) ON MALE MICE TREATED WITH IODINE-131 SURING THEIR FETAL PERIOD. Bajrakova, A. K. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 5-8(1972).

Male mice on the 16th day of fetal development were exposed to irradiation as a result of the incorporation of 125 μCi of ^{131}I. From the testicles of animals attaining 5 months of age, a preparation was prepared for the cytogenetic analysis of the meiotic chromosomes in the diakinesis-metaphase I of the initial spermatocytes. Fragments added on to clearly normal figures were observed. These are the result of aberrations of the genetic structure of germ cells in fetuses exposed to ^{131}I. (tr-auth)

11682 NON-REPAIRABLE STRAND BREAKS INDUCED BY ^{125}I INCORPORATED INTO MAMMALIAN DNA. Painter, R. B. (Univ. of California, San Francisco); Young, B. R.; Burki, H. J. Proc. Nat. Acad. Sci. U. S. A.; 71: No. 12, 4836-4838(Dec 1974).

When ^{125}I is incorporated into Chinese hamster DNA (via ^{125}I-labeled iododeoxyuridine) and the cells are stored at 77°K, the resulting decays of the isotope cause 4 to 5 breaks/single-strand per disintegration. On the average, about 50% of these breaks are repaired. In contrast, under the same conditions of storage and in the same range of total strand breaks/cell, 70 to 100% of the breaks induced by x-radiation are repaired. Thus, the extreme toxicity of ^{125}I when incorporated into DNA is correlated with the unrepaired breaks caused by decay of this isotope. These results suggest that unrepaired DNA strand breaks may be important in cell killing after treatments which damage DNA. (auth)

11683 PREVENTION OF EHRLICH ASCITES TUMOR USING INTRAPERITONEAL COLLOIDAL ^{198}Au. Rogoff, E. E.; Romano, R.; Hahn, E. W. (Memorial Hospital, New York). Radiology; 114: No. 1, 225-226(Jan 1975).

From 59th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (25 Nov 1973).

Previous work has shown that radioactive colloids can cure Ehrlich ascites tumor in mice. In this experiment, the dose of colloidal ^{198}Au needed was correlated with the number of tumor cells inoculated. On Day 1, varying numbers of Ehrlich cells (10^2, 10^3, 10^4, 10^5, 10^6) were injected intraperitoneally into 310 BALB/c male mice. Two hours later, varying doses (10, 20, 40, 80, and 160 μCi) of ^{198}Au were injected intraperitoneally. Controls were injected with normal saline. Generally, the lower cell inoculums and higher doses of ^{198}Au yielded better survival rates. (auth)

11684 CHROMOSOMAL ABERRATIONS IN THREE SUCCESSIVE CELL CYCLES OF WALLABIA BICOLOR LEUKOCYTES AFTER TRITIATED THYMIDINE INCORPORATION. Geard, C. R. (Australian National Univ., Canberra). Radiat. Res.; 61: No. 1, 118-127(Jan 1975).

An analysis of the chromosomes of Wallabia bicolor over three successive cell cycles after incorporation of tritiated thymidine has shown a substantial level of tritium-induced chromosomal aberrations in each cycle. Aberration levels are higher in second- than in first-division postlabel cells, and are still considerable in third-division cells. In chromosomes labeled along their entire length aberration frequency is correlated with metaphase length; in partly labeled chromosomes at the third cell cycle, aberrations are concentrated in labeled regions. These two findings indicate an intranuclear effect of tritium. Some cells with aberrant chromosomes survive into later divisions. There is little tendency for nonrandom association between chromosomes when aberrations are formed. (auth)

Plants

Refer also to abstract 11691.

11685 (AEC-TR-7592, pp 65-69) EFFECT OF FISSION PRODUCTS OF ^{235}U ON THE MUTATION PROCESS IN CHLORELLA CULTURES. Shevchenko, V. A.; Alekseenok, A. Ya.; Prister, B. S.; Ryabov, G. G. (Inst. of General Genetics, Moscow). Dec 1974. Translated from pp 102-108 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Data are given on the effects of nuclear fission products 14, 50, and 480-hour old on the dynamics of the mutation process in cultures of Chlorella vulgaris Beiyer. During the first stage of experiments, the number of mutant cells increased in proportion to the dose rate. When the dose rate was reduced and toward the end of the experiments, when the intensity of irradiation was close to constant, the number of mutants in the irradiated populations was maintained at a level prescribed by the irradiation dose. (auth)

Microorganisms

11686 (AEC-TR-7592, pp 33-35) SURVIVAL AND GAS FORMATION OF DENITRIFYING BACTERIA IN THE PRESENCE OF RADIOACTIVE SUBSTANCES IN WATER. Zhogova, V. M. Dec 1974. Translated from pp 57-61 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Strontium-90 and ^{210}Po in high concentrations ($4 \cdot 10^{-3} - 1 \cdot 10^{-4}$ curie/liter) in water slightly inhibited the development of denitrifying bacteria as compared to the control, but did not strongly prevent their accumulation in the medium. ^{90}Sr and ^{210}Po in concentrations of $1.6 \cdot 10^{-10} - 1.6 \cdot 10^{-4}$ curie/liter did not have any noticeable effect on the process of gas formation in the accumulative cultures of denitrifying bacteria. (auth)

Nuclide Kinetics and Toxicology

11687 (AEC-TR-7592, pp 70-73) DETERMINATION OF SMALL ACTIVITIES IN BIOLOGICAL SAMPLES AND ENVIRONMENTAL OBJECTS. Buyanov, N. I.; Pogudin, V. V.; Prudnikov, L. V. Dec 1974. Translated from pp 109-115 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Measurements of the radioactivity of samples in columns encircling a ϕ70.70 crystal, in most cases, have advantages over measuring the same crystal in a well. The determination of radioactivity in small samples should be done with a crystal in a well. The use of a large column (up to 1 or even 10 liters) makes it possible to detect radionuclides in raw samples, which shortens the time of the analysis and makes it possible to reuse the material (fish, algae) after the test for other purposes. (auth)

Man

Refer also to abstracts 11581, 11657, 11661, 11663, 11743, and 13499.

11688 (COO-1500-25) RADON PROGENY INHALATION STUDY. Final Report. Schiager, K. J. (Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). Oct 1974. Contract AT(11-1)-1500. 14p. Dep. NTIS $4.00.

Results are summarized from a nine-year study on Rn progeny inhalation exposures of uranium miners. The radioactivity in aerosols collected in uranium mines was measured and activity concentrations and ratios of individual Rn daughters were determined in relation to aerosol particle size. The total deposition of Rn progeny in the respiratory tract of working uranium miners was measured by means of external γ-ray counting of ^{212}Pb and ^{208}Tb and by sampling inhaled and exhaled air in controlled breathing experiments. The distributions of inhaled ^{222}Rn, ^{210}Pb, and ^{210}Po in urine, feces, blood, and hair of exposed individuals were measured. Definite correlations were found between activity concentrations in blood and hair and cumulative inhalation exposures. Facial whiskers were judged to be the most promising bioassay medium. However, it was concluded that bioassay methods are not practical for the dosimetry of inhalation exposures, since all sources and rates of ^{210}Pb intake must be accounted for and this would require a tremendous air sampling effort. A 12-m^3 aerosol exposure chamber was constructed and used for controlled exposures and for the calibration of air sampling equipment. A battery-powered personal air sample for use by uranium miners was developed and tested that uses thermoluminescent (TLD) dosimeters and integrates the Rn progeny activity collected on membrane filters. The results of tests under mine conditions and miner acceptance of its use proved disappointing. Alpha spectrometry methods were developed as basic calibration systems for determining airborne Rn progeny concentrations and a direct-reading meter was developed that converts radioactivity measurements to units of working levels for uranium miners. The effectiveness of various filter-type respirators against Rn progeny inhalation was evaluated and it was found that half-mask respirators equipped with a suitable filtration medium provided a high degree of protection when properly used. (CH)

11689 AGE VARIATION IN THE UPTAKE OF RADIOIODINE IN THYROTOXICOSIS. Nilsson, G.; Moeller, T. (Lunds Lasarett, Sweden). Acta Radiol., Ther., Phys., Biol.; 13: No. 3, 201-204(1974).

A negative correlation was found between age and ^{131}I uptake after 2 hours but not after 24 hours in a material of 82 hyperthyroid patients; the negative correlation applied in both diffuse and nodular toxic goitres, and is probably related to the diminished uptake with increasing age previously reported in euthyroid subjects. The age variation deserves consideration when this technique is used in the differential diagnosis of thyrotoxicosis. (auth)

11690 METABOLISM OF CESIUM-137 AND STABLE POTASSIUM IN MAN. Keslev, D. D.; Boyadzhiev, N. A.; Novakova, E. T.; Kerteva, A. A.; Yakimov, L. H. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 85-91(1972).

A determination was made of the amounts of cesium-137 and stable potassium entering the organism in various age groups with the daily food intake and their content in the urine and feces that are eliminated. A correlation was not established between the total amount of entering cesium-137 and stable potassium, and the amount eliminated with the urine and feces. Moreover, determinations were made on discrimination coefficients of the cells urine/food and feces/food, which in all age groups approached 1. For confirming the concentration of cesium-137 entering the organism, a preference was shown for analysis of the urine. (tr-auth)

Animals

Refer also to abstracts 11667–11670, 11675, 13503, 13511, 13518, 13524–13526, and 13528.

11691 (AEC-TR-7592) RADIOECOLOGY OF WATER ORGANISMS. Vol. 3. The Effects of Ionizing Radiation on Water Organisms. Andrushaytis, G. P. (ed.). Dec 1974. Translation of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973. 99p. Dep. NTIS $5.45.

Separate abstracts were prepared for the 17 papers presented at the symposium in April, 1972, in Riga. (HLW)

For abstracts of individual papers see: 10562, 11540–11542, 11650, 11651, 11667–11672, 11685–11687, 11692, and 11716.

11692 (AEC-TR-7592, pp 36-40) ACCUMULATION OF ^{90}Sr–^{90}Y AND ITS EFFECT ON THE SPAWN AND LARVAE OF CTENOPHARYNGODON IDELLA. Nilov, V. I. (Inst. of Zoology, Alma-Ata, USSR). Dec 1974. Translated from pp 62-69 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

The coefficients of accumulation of ^{90}Sr and ^{90}Y by Ctenopharyngodon idella (Val.) eggs in $^{90}SrCl_2$ solutions of different concentrations are values of the same order, but the dynamics of the accumulation is different. The death rate of eggs and the number of morphological abnormalities in the larvae increased when the concentration of the solution was changed from $1.39 \cdot 10^{-4}$ to $1.10 \cdot 10^{-6}$ curie/liter. (auth)

11693 (BNWL-SA-5042(Rev.)) EFFECTS OF INHALED URANIUM MINE AIR CONTAMINANTS IN BEAGLE DOGS. Filipy, R. E.; Stuart, B. O.; Palmer, R. F.; Ragan, H. A.; Hackett, P. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. Contract AT(45-1)-1830. 19p. (CONF-740648-7). Dep. NTIS $4.00.

From symposium on experimental respiratory carcinogenesis and bioassays; Seattle, Washington, USA (23 Jun 1974).

In order to determine the combined or separate roles of radon daughters and cigarette smoking in the development of lung cancer and other respiratory tract pathology, groups of 20 dogs each received daily lifespan exposures to four hours of 600 Working Levels of radon daughters with ore dust, and/or cigarette smoking over 16 hours/day, 7 days per week, or both; control dogs received sham-smoking. After four years of exposure, respiratory tract pathology included macrophage accumulation, septal fibrosis, epithelial hyperplasia, endothelial proliferation, vesicular and bullous emphysema, and extensive epithelial changes involving squamous metaplasia with atypical nuclei. These effects were primarily related to exposure to radon daughters and uranium ore dust. (auth)

11694 (CEA-R-4630(1)) STUDY OF THE ACCUMULATION OF SOLUBLE AND INSOLUBLE FORMS OF ^{59}Fe BY MARINE MOLLUSC AND FISH (MYTILUS EDULIS AND BLENNIUS PHOLIS). I. Effects of Temperature and Light on Species-Pollutant Interactions. Fraizier, A. (CEA Centre de La Hague, 50-Cherbourg (France). Service de Recherches Toxicologiques et Ecologiques). Nov 1974. 43p. (In French). Dep. NTIS (US Sales Only) $5.25.

The interactions between marine mollusc and fish (Mytilus edulis and Blennius pholis) and ^{59}Fe were studied as a function of the physico-chemical (soluble or insoluble) forms of the radionuclide in seawater, and physical parameters of the environment (temperature and light). Changes in environmental conditions modified exchanges between species and pollutant, whatever its physico-chemical nature. Besides variation of contamination kinetics, these environmental changes resulted in a decrease of ^{59}Fe accumulation whenever they led to slower metabolic activities; an increase of the contaminating capacity of the insoluble forms, as compared with soluble forms, was also noticed. Passive processes of adsorption of the radionuclide might occur; a partial rejection process was observed, especially with insoluble compounds. (FR)

11695 (CONF-741002-P2, pp 716-722) LANTHANUM-INDUCED ALTERATIONS IN ^{45}Ca AND ^{147}Pm DISTRIBUTION IN VASCULAR SMOOTH MUSCLE. Goodman, F. R.; Weiss, G. B. (Univ. of Texas Southwestern Medical School, Dallas). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The effects of La^{+++} on the uptake and distribution of ^{45}Ca and of ^{147}Pm were examined in rabbit aortic smooth muscle. As the La^{+++} concentration was increased from 1.5 mM to 15 mM (in the presence of $O-Ca^{++}$ and 1.5 mM Ca^{++}), ^{45}Ca tissue space and superficial binding were decreased; at higher La^{+++} concentrations, the ^{45}Ca space magnitude approximated that of the extracellular compartment. Efflux of ^{45}Ca was not blocked in the presence of 1.5 mM or 10 mM La^{+++}. A carrier-free rare earth ion, ^{147}Pm, was used as a La^{+++} analogue to delineate extracellular and cellular binding sites for La^{+++}. Lanthanum decreased ^{147}Pm uptake by a greater amount than was obtained with Ca^{++} and, in efflux experiments, La^{+++} but not Ca^{++} tran-

siently increased ^{147}Pm release. On this basis, superficially-bound ^{45}Ca or ^{147}Pm is displaced by La^{+++} but significant quantities of ^{147}Pm are not displaced by Ca^{++}. Thus, La^{+++} can occupy essentially all surface-accessible Ca^{++} sites in aortic smooth muscle and block penetration of ^{45}Ca beyond the functional extracellular space. (auth)

11696 (EUR-5033e) RADIOTOXICITY OF TRITIUM IN MAMMALS. Critical Analysis of the Extrapolation to Man of the Results of Tritium Incorporation into Animal Tissues. Silini, G.; Metalli, P.; Vulpis, G. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari). 1973. 37p. Dep. NTIS (US Sales Only) $5.00. EUR B. Fr. 50.-.

Basic data relative to tritium, its physicochemical behavior in the environment, its major sources of contamination, and its metabolism through the mammalian organisms are reviewed. After considering the radiotoxicity of tritium particularly at the cellular and whole-body level the conclusion is drawn that the major uncertainties regard the fraction of tritium incorporated into the nuclei of some tissues. This fraction is eliminated very slowly and is capable of modifying the genetic structures of the nucleus. A more refined analysis of radiobiological phenomena and a better knowledge of the dose effect relationship should permit the extrapolation of the data to the low doses of tritium contamination. This extrapolation is of great interest in the field of public health for the elaboration of the relevant radioprotection standards. (INIS)

11697 BIOSYNTHESIS OF IODININ: INCORPORATION OF D-[1-^{14}C]-, D-[6-^{14}C]-, AND D-[1,6,7-$^{14}C_3$]- = SHIKIMIC ACID. Herbert, R. B.; Holliman, F. G.; Sheridan, J. B. (Leeds Univ., Eng.). Tetrahedron Lett.; No. 48, 4201-4204(Nov 1974).

Reference is made to earlier results from the authors' laboratory (Herbert et al., Tetrahedron Letters; 151 (1974)) giving the distribution of D-[6-^{14}C] shikimic acid label in iodinin. It is stated that these results were at variance with those reported for iodinin and phenazine-1-carboxylic acid from the same precursor (Hollstein et al., J. Org. Chem.; 38:3415 (1973)), and that both sets were incompatible with earlier results on iodinin derived from DL-[1, 6-$^{14}C_2$] shikimic acid (Podojil et al., Biochemistry; 9:4616 (1970)). To resolve the uncertainties of interpretation D-[1-^{14}C] shikimic acid was fed in the experiments now reported. The results are discussed. (UK)

11698 COMPARATIVE STUDIES ON TOXICITY AND EFFECTIVENESS OF DTPA CHELATES: Na_3[CaDTPA], Na_3[ZnDTPA], AND Na_3[MnDTPA], IN REMOVING ^{46}Sc, ^{65}Zn, AND ^{144}Ce FROM THE RAT BODY. Szot, Z. (Inst. of Nuclear Research, Warsaw); Zylicz, E.; Zablotna, R.; Geisler, J.; Czechowska, Z. (Inst. of Nuclear Research, Warsaw). Nukleonika; 19: No. 10, 917-931(1974). (In Polish).

Rats, internally contaminated with ^{46}Sc, ^{65}Zn, or ^{144}Ce, were intravenously injected with DTPA chalates of Ca, Zn, or Mn. Decontamination effectiveness of the chelates was estimated by means of measuring radionuclide retention in the whole body as well as in several organs of the rats. Na_3[ZnDTPA] was found to be the most efficient agent in removing ^{65}Zn from the rat body whereas all the investigated chelates were approximately equally effective with regard to ^{46}Sc and ^{144}Ce. Histological examination of the parenchymal organs of the rats revealed side effects of the chelate administration, namely hydropic degeneration of the epithelium of the renal tubules and diminution of the number of basophilic granules in the cytoplasm of the liver cells. Observation of those changes makes it possible to arrange the investigated chelates in the following order of the decreasing toxicity: Na_3[MnDTPA], Na_3[ZnDTPA], Na_3[CaDTPA]. (auth)

11699 EFFECTIVENESS OF REMOVING RADIOACTIVE ISOTOPES FROM RAT BODY BY MEANS OF DTPA COMPLEXES WITH THE SAME BUT NON-RADIOACTIVE METALS. Zablotna, R.; Geisler, J.; Szot, Z.; Zylicz, E. (Inst. of Nuclear Research, Warsaw). Nukleonika; 19: No. 10, 905-915(1974). (In Polish).

Efficiencies of DTPA chelates with scandium, manganese, and cerium in removing ^{46}Sc, ^{54}Mn, and ^{144}Ce from the rat body were compared with the previously estimated efficiencies of calcium and zinc chelates, when used for removing ^{46}Sc, ^{65}Zn, and ^{144}Ce. The effect of isotope dilution on the removal of ^{54}Mn from the rat body was estimated. The removal of the bivalent radioactive metals was found to be the most efficient with the DTPA chelates of the same but non-radioactive metals. No such a relation was observed in case of the trivalent metals. Differences in the stability of the bonds with endogenous ligands as well as an ability of the bivalent metals to form binuclear complexes with DTPA are considered to be responsible for the dissimilarity in the behavior of the two groups of metals. (auth)

11700 DIFFERENCE OF ^{133}Xe AND ^{125}I AND EXTRACTION OF ^{86}Rb IN SUBCUTANEOUS ADIPOSE TISSUE DURING SYMPATHETIC NERVE STIMULATION. Linde, B.; Gainer, J. L. Acta Physiol. Scand.; 91: No. 2, 172-179(1974).

Effects of sympathetic nerve stimulation on the disappearance rates of $^{133}Xenon$ and $^{125}Iodide$ from a local depot as well as on the extraction of $^{86}Rubidium$ from blood have been studied in the subcutaneous adipose tissue of dogs during constant blood flow perfusion. Resting mean k-values for $^{133}Xenon$ were 0.0040 min^{-1} (n = 10) and for $^{125}Iodide$ 0.0386 min^{-1} (n = 5) while the PS-products for $^{86}Rubidium$ had a mean value of 2.5 ml × min^{-1} × 100 g^{-1} (n = 17). During sympathetic nerve stimulation a frequency dependent decrease of disappearance rates and PS-products was found. The latter were reduced by an average of 30% while the reductions of the disappearance rates were twice as large and similar for $^{133}Xenon$ and $^{125}Iodide$. These results suggest a decrease in the perfused capillary surface area during sympathetic nerve stimulation. (auth)

11701 DISTRIBUTION OF ^{198}Au INJECTED INTRAVENOUSLY AS A COLLOID AND IN SOLUTION. Saeterborg, N. E. (Umeaa Univ., Sweden). Acta Radiol., Ther., Phys., Biol.; 12: No. 6, 509-528(1974).

The distributions of colloidal and soluble ^{198}Au were compared after their injection in mice. The investigation confirmed earlier findings that colloidal ^{198}Au behaves as an ideal colloid, i.e. is rapidly cleared from the bloodstream by reticulo-endothelial activity mainly in the liver, spleen, and bone marrow. The injection of soluble ^{198}Au produced a higher concentration in the kidneys and a lower one in the liver, spleen, and bone marrow than injection of colloid. (auth)

11702 PASSAGE OF TRITIUM WITH DRINKING WATER INTO THE BODY OF RATS AND THEIR PROGENY IN A CHRONIC TEST. Moskalev, Yu. I.; Lyaginskaya, A. M.; Isotomina, A. G. Gig. Sanit.; No. 11, 35-37(Nov 1974). (In Russian).

The kinetics of tritium accumulation in the body of rats (male and female), pregnant rats, and young rats in case of chronic entry of tritium oxide with the drinking water were studied. The finding was, that when mixed feeding-stuffs were given, the tritium contents in the water phase of the body of adult rats amounted to 42 to 44 per cent of its concentration in the drinking water and in the water phase of young rats on the 3rd to 15th day it equaled 28 per cent. No placental barrier existed for tritium oxide in the body of pregnant rats. (auth)

11703 METABOLIC ROUTES OF ^{239}Pu AT EARLY PERIODS FOLLOWING ITS INTRODUCTION. Zapolskaya, N. A.; Fedorova, A. V.; Borisova, V. V.; Nechaev, Kh. K.; Dolgirev, E. I. (Leningrad Scientific Research Inst. of Radiation Hygiene). Med. Radiol.; 19: No. 11, 74-76(Nov 1974). (In Russian).

White male rats were injected with ^{239}Pu as the chloride in aqueous solution at pH of 3.0 to 4.0. In vitro measurements were made of the α activity of different organs at 3 hrs and 1, 3, and 6 days after the injection. In vivo measurements were made of the γ activity of Am. The activity in the liver, bone tissue, intestines, muscles, and blood plasma was determined, and the results are tabulated. They indicate that a gradual redistribution of the ^{239}Pu occurs changing from a hepatotropic pattern to an osteotropic pattern. (JSR)

11704 TRANSFER OF ^{65}Zn THROUGH PLACENTA AND MILK IN MICE. Matsusaka, N. (Iwate Univ., Morioka, Japan). Radioisotopes (Tokyo); 23: No. 3, 186-187(Mar 1974).

The placental transfer of ^{65}Zn in mice and the uptake of the milk-borne ^{65}Zn by the young until their weaning were determined. Pregnant mice were injected 3 days before delivery with 0.1 ml of 50μCi/ml solutions of ^{65}Zn. The ^{65}Zn body burden of the new-borns on the day of delivery was 2.7% of the radioactivity administered to the dam. If nursed by a contaminated dam, the ^{65}Zn content increased for 10 days then gradually declined. If nursed by an uncontaminated dam, the ^{65}Zn content steadily declined from the day of birth. From the 10th day on, the milk-borne ^{65}Zn makes a larger contribution to total body burden in the mice than does the transplacental ^{65}Zn. (ERB)

11705 ON CERTAIN ASPECTS OF THE ^{75}Se METABOLISM IN THE ORGANISM OF GROWING CHICKENS. Stanchev, Kh. Zhivotnovud. Nauki; 10: No. 3, 11-20(1973). (In Bulgarian).

Two experiments were conducted to study the metabolism of ^{75}Se as well as the effect of the addition of different levels of selenium dioxide to it. The chickens were given 4 μCi per 1 kg body weight of ^{75}Se in the form of Na_2SeO_3 and blood samples were collected from the wing vein at definite intervals of time. Radioactivity was followed up in the liver, kidney, pancreas, femoral muscle, brain, spleen, testes, blood, keel bone and crural bone (epiphysis and diaphysis). The amount of ^{75}Se excreted by feces and urine was investigated at the 24th, 48th and 72nd hour after the administration of radioselenium. The resorption of radioselenium from the digestive tract of chickens was most intensive

between the 4th and 7th hour, then a decrease in the resorption rate was observed. Highest accumulation of ^{75}Se was recorded in the liver and kidney—between the 2nd and 4th hour, and between the 5th and 7th hour, respectively. Lowest radioactivity was measured in the muscles which remained relatively constant up to the 72nd hour. In the brain there was a slow enhancement of the radioactivity up to the 72nd hour, whereas in the pancreas it increased up to the 6th hour and changed insignificantly at the next intervals of time. In the keel bone the highest was the radioactivity by the 6th hour; it remained at the same level till the 48th hour, followed by a slow decrease. In the diaphysis the incorporation of ^{75}Se was approximately by 1.5 to twice lower in comparison with the epiphysis of the crural bone. The quantity of ^{75}Se excreted by feces and urine at the 24th hour after administration of radioselenium accounted for 15.15%, and in the course of 72 hours a total of 21.31% of the dose administered was excreted. When the amount of selenium added to the basic ration increased, the radioactivity of ^{75}Se in the blood dropped, the lowest level being recorded in the group that received 6.0 mg of SeO_2 per 1 kg feed. The increased doses of selenium dioxide added to the feed of the chickens led to a decrease in the incorporation rate of ^{75}Se in the organs and tissues studied of the experimental groups in comparison with the control group. The excretion of radioselenium by feces and urine was highest in the group that received 6.0 mg SeO_2 per 1 kg feed followed by the group that had received 2.0 mg; the lowest excretion was found in the control group. In the course of 72 hours the excretion accounted for 22.60% of the dose administered in the control group, whereas in the groups that were given 2.0 and 6.0 mg SeO_2 per 1 kg feed it was 30.99 and 34.36%, respectively. (auth)

11706 ACCELERATED EXCRETION OF RADIOACTIVE IODINE BY MEANS OF SOME PHARMACOLOGICAL SUBSTANCES. Mikhajlov, M. A.; Pavlova, V. B. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 51-56(1972).

A study was made of the effect of a number of pharmacological substances for the accelerated removal of radioactive iodine-131 from the organism of Wistar rats. The animals were subjected to a daily dose of potassium iodide, potassium perchlorate, saluretin, degidratin, and laziks separately or in combination. The effect was estimated radiometrically from the amount of iodine-131 in the urine eliminated per day. The most effective of the pharmacological substances used separately to remove iodine-131 were: potassium perchlorate (86%), potassium iodide (82%) and the diuretics (65 to 70%). The greatest effect can be attained with the combined use of potassium iodide with laziks (93%) and of potassium iodide with potassium perchlorate (91%). (tr-auth)

11707 COMBINED USE OF ION-EXCHANGE RESINS AND OSMOTIC DIURESIS TO REDUCE IODINE-131 CONCENTRATION IN CRITICAL ORGANS. Nikolov, I. T.; Bokova, N. V.; Kiradzhiev, G. D. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 43-50(1972).

The combined effect of a number of ion-exchange resins and of osmotic diuresis with the purpose of decreasing the accumulation of iodine-131 in critical organs of rats was studied. As an osmotic diuretic the ion exchange resin Dowex 21K and mannitol were subject to test. The resin was fed to the organism by mouth 60 minutes before and 10, 30, and 60 minutes after application of the isotope. The results show that the use of anion resin Dowex 21K leads to a successful decrease in the ability to adsorb iodine-131 by the gastrointestinal tract and to a decrease in the concentration of iodine-131 in critical organs. The most effective results can be observed on using the resin 10 to 30 minutes after the organism receives the iodine-131. The independent utilization of mannitol does not give positive results, and its combined introduction with Dowex 21K leads to a decrease in the positive effect attained by the resin. (tr-INIS)

11708 EXPERIMENTAL ENDOTOXIN KERATITIS. Study of ^{45}Ca Incorporation In Vivo into the Aqueous Humour and Cornea. Obenberger, J. (Oftalmologicka Laborator CSAV, Prague); Babicky, A. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu). Cesk. Oftalmol.; 29: No. 5, 347-349(Sep 1973). (In Czech).

Experimental keratitis was induced in rabbits by intracorneal injection of endotoxin Salmonella typhi Difco. The animals were studied on the 6th day following injection, when the inflammatory reaction was characterized by ring-shaped opacities and a heavy vascularization of the cornea. The penetration of intravenously injected ^{45}Ca into the aqueous humour and the cornea was studied. The weight of the inflamed corneas increased three times in comparison with the weight of both controls, i.e. the corneas of the contralateral eyes and the corneas in normal rabbits. The penetration of ^{45}Ca into the aqueous humour of the eye with keratitis was found a little decreased as well as the incorporation into the corneal stroma, measured with respect to the stromal wet weight. There were no differences between the values for both controls. (auth)

11709 STUDIES OF IODINE-131 KINETICS IN THE LABORATORY MOUSE. Part 2. Radioactive Iodine Kinetics in Fetus and Newborn Following Oral Administration to Pregnant Mice. Vasilev, G.; Bajrakova, A. K.; Filev, G. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 35-42(1972).

The change of the activity of the fetus up to the termination of its development in the womb and in the newborn during the lactation period after incorporation of 125 μCi of ^{131}I in the pregnant mice on the 12th and 16th day after insemination was studied. The distribution of the radioisotope in the body of the newborn was determined. The activity, transmitted in the milk per day, was also measured. The results obtained emphasize the value of the period of fetal development during introduction of the radioisotope with respect to both the qualitative and quantitative characteristics of its kinetics in the fetus—womb system. (tr-auth)

11710 STUDIES ON IODINE-131 KINETICS IN THE LABORATORY MOUSE. Part 1. Radioactive Iodine Kinetics Following Oral Administration to Sexually Mature Nonpregnant and Pregnant Animals. Vasilev, G.; Bajrakova, A. K.; Filev, G. (Nauchno-Izsledovatelski Inst. po Radiologiya i Radiatsionna Khigiena, Sofia (Bulgaria)). Sci. Pub., Res. Inst. Radiol. Radiat. Hyg.; 4: 27-34 (1972).

The changes occurring with time in the whole-body activity and in the concentration of radioactive iodine in the blood and urine and its concentration in areas of accumulation (thyroid gland, stomach, small intestines, and bladder) and in the other parts of the body were studied after single oral introduction of 125 μCi of ^{131}I in nonpregnant and pregnant mice on the 4th, 12th, and 16th day after insemination. The data obtained indicates the very accelerated elimination of the radioactive isotope and, in this connection, the distribution of the residual activity when it is introduced to the pregnant mice in the initial stages of pregnancy. (tr-auth)

11711 ON SOME ASPECTS OF THE METABOLISM OF ^{75}Se IN THE ORGANISM OF GROWING CHICKENS. Stanchev, Khr. Zhivotnovud. Nauki; 3: 11-20(1973). (In Bulgarian).

Russian and German summary.

The metabolism of ^{75}Se and the effect of the addition of selenium dioxide under various conditions on this metabolism were studied. Selenium-75 was fed internally to the chickens up to 4 μCi per 1 kg of weight. The radioactivity of the liver, kidneys, pancreatic gland, brain, testicles, spleen, blood, sternum, and femur was determined. Resorption of the ^{75}Se was very intense between the 4th and 7th hrs, after which a decrease in its intensity was observed. The uptake of ^{75}Se was observed first in liver and kidneys. The radioactivity was much lower in the muscles. The amount of ^{75}Se eliminated by the feces and urine by the 23rd hr is 15.15% and during 72 hrs is 21.31%. (tr-auth)

11712 ZINC EXCHANGE IN BIRD'S ORGANISM. Dynamics of Resorption and Distribution of ^{65}Zn in the Organism of Chickens. 1. Communication. Ermenkov, K. Nauch. Tr., Vissh Selskostop. Inst., Plovdiv; 22: 359-367(1971). (In Bulgarian).

Russian and English summaries.

Experiments were carried out with 60 male chickens of the White Plymouth Rock breed to study the dynamics of resorption and distribution of ^{65}Zn. Analyses indicated that ^{65}Zn resorption took place as early as the first 60 min, but the peak was attained by the 120th min after the isotope was administered orally. The maximal incorporation of ^{65}Zn into the viscera took place between the 3rd and 4th hour, the most intensive exchange being observed in the pancreas, liver, lungs, and kidneys. A considerably slower exchange of zinc took place in the cerebrum, muscles, and bone tissue, preceded in this respect, by the spleen and thymus. (auth)

11713 ZINC EXCHANGE IN THE BIRD'S ORGANISM. Excretion and Distribution of ^{65}Zn in the Organism of Cocks. 2. Communication. Ermenkov, K. Nauch. Tr., Vissh Selskostop. Inst., Plovdiv; 22: 351-358(1971). (In Bulgarian).

Russian and English summaries.

Under the conditions of an uninterrupted experiment (5 days and nights with the aid of the fistula method and the setting up of an artificial anus) were studied the routes, the degree of emission, and the distribution of ^{65}Zn in the organism of cocks. The incorporation of ^{65}Zn in the pancreatic juice and the bile took place, although to a lesser extent, as early as the first 60 min after the isotope was injected. The radioactivity of these two digestive juices gradually increased until the 7th to 8th hour, and then began to drop. With the pancreatic juice was eliminated a considerably larger amount of ^{65}Zn than with the bile. During the

experiment, cocks retained 84.85% of the injected ^{65}Zn and discharged 15.15% by the feces and urine. The elimination of the ^{65}Zn took place mainly through the digestive tract (14.33%) and in a considerably lesser degree by way of the kidneys (0.82%). Fecal Zn had its origin mainly from the zinc which was eliminated, via the pancreatic juice. The liver and the pancreas appeared to be the organs of highest content of radioactive Zn. The least per cent of isotope incorporation was established in the cerebrum and the muscles, preceded in this respect, by the kidneys, testes, and bones. (auth)

11714 STUDIES ON QUANTITATIVE MORPHOLOGY. IV. Relationship Between Follicle Size and ^{131}I Uptake in the Avian Thyroid Gland. Loew, O.; Stiller, K. J. (Jena Univ. (German Democratic Republic). Inst. fuer Pathologische Physiologie). Exp. Pathol.; 8: No. 5-6, 371-373(1973).

Following administration of 10 μCi/kg ^{131}I noticeable differences in iodine uptake were observed in the thyroid follicles of budgerigars (Melopsittacus undulatus). Comparing the colloid areas in histological slices with the above mentioned metabolic activities in most cases only the mean values showed a partially even insignificant relationship. In the particular case it was not possible to conclude from follicle size on ^{131}I uptake. (INIS)

11715 BIOLOGICAL EFFECTS OF D_2O ADMINISTRATION TO COTURNIX JAPONICA. Sutton, S. P.; Dam, R.; Nielsen, M. K. (Univ. of Nebraska, Lincoln). Life Sci.; 15: No. 12, 2097-2108(15 Dec 1974).

Levels of 7.8, 18.5, and 26 mole % deuterium oxide were administered sequentially to Coturnix japonica (Japanese quail) via the drinking water. The primary effect observed was on egg frequency, which decreased from a normal level of 0.89 for 7.8 mole % D_2O to a low of 0.38 during the administration of 26 mole % D_2O. Adverse symptoms, such as hyperexcitability, convulsions, skin ulcerations, comatosity, weight loss, or death, which have been associated with deuterium toxicity in other animals, were not observed in these experiments. The amount of deuterium deposited in the water of the egg was 6.9, 13.98, and 19.83 mole % when 7.8, 18.5 and 26 mole % deuterium respectively was administered. For each period, the deuterium content of egg water rapidly reached a maximum concentration after which the concentration decreased slightly. This dilution effect has not been noted previously in body fluids from other animals. (auth)

Plants

Refer also to abstract 13498.

Microorganisms

Refer also to abstract 11686.

11716 (AEC-TR-7592, pp 41-46) INCORPORATION OF ^{3}H, ^{14}C, AND ^{91}Y IN THE CHROMOSOMES OF DINOFLAGELLATA. Polikarpov, G. G.; Tokareva, A. V.; Tsytsugina, V. G. Dec 1974. Translated from pp 70-72 of Radioekologiya vodnykh organizmov. Vol. 3. Vliyanie ioniziruyushchei radiatsii na gidrobionty, Izdatel'stvo Zinatne, Riga, 1973.

Distribution of ^{91}Y in comparison with ^{3}H and ^{14}C in the membrane, protoplasm, and nucleus of unicellular organisms, Dinoflagellata, was studied. The ^{3}H, ^{14}C, and ^{91}Y were included in the cell chromosomes. (auth)

New Tracer Techniques

Refer also to abstracts 11315, 11581, and 13514.

11717 (CONF-740574-(Absts.)) PROVISIONAL PROGRAM AND ABSTRACTS OF PAPERS PRESENTED TO THE FIFTH ANNUAL SCIENTIFIC MEETING, SYDNEY, 22nd–24th MAY 1974. Newton, P. J. F. (ed.). (Australian and New Zealand Society of Nuclear Medicine, North Melbourne (Australia)). [nd]. 53p.

Abstracts are given of papers presented at the 1974 annual scientific meeting of the Australian and New Zealand Society of Nuclear Medicine. (AT)

11718 (IAEA-R-821-F) IN VITRO RADIOISOTOPE STUDIES OF THE METABOLISM OF NUCLEIC ACIDS IN MEGALOBLASTIC ANAEMIA, Final Report. Luzzatto, L. (International Atomic Energy Agency, Vienna (Austria)). Mar 1974. 5p. INIS.

The involvement of nucleic acids in the megaloblastic maturation of haemopoietic cells was studied by means of in vitro procedures. DNA and RNA extracts obtained before and after incubation of normoblastic and megaloblastic cells with ^{3}H-5-uridine and ^{3}H-6-uridine were analyzed. The RNA and DNA content, expressed per cell or related to protein content, varied in normal and abnormal samples. However, the RNA/DNA ratio was consistently higher in megaloblastic marrows. The incorporation of radioactive uridine into RNA was higher in megaloblastic than in normoblastic cells. In megaloblastic cells there was a relative scarcity of the 45 S component, and in some experiments also of 28 S and 18 S RNA, suggesting an abnormality in ribosome production. A 9 S RNA peak, probably haemoglobin mRNA, was detected in normoblastic and megaloblastic marrows. It was found that deoxyuridine can be incorporated into DNA when conversion of dUMP to dTMP is inhibited by folic acid deprivation and ^{3}H-deoxyuridine (dU) was present in DNA digests. BHK cell cultures treated with MTX were used as a possible simplified model of folate-deficient human bone marrow cells. Although small amounts of ^{3}H-deoxyuridine were detected in BHK cell DNA, no significant difference between MTX-treated and control cultures under the experimental conditions used were found. The results obtained indicate that nucleic acid synthesis is altered not only in a quantitative, but also in a qualitative manner in human megaloblastosis caused by folic acid deficiency. The presence of deoxyuridine in mammalian cell DNA is here reported for the first time, although it is known that bromodeoxyuridine can replace thymidine in bacteria. The DNA anomaly could explain most of the biochemical and haematological changes known to occur in folate deficiency, especially the ineffective erythropoiesis. (INIS)

11719 (STI/DOC-10-157) ISOTOPE STUDIES ON WHEAT FERTILIZATION. Results of a Four-year Co-ordinated Research Programme of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture. (International Atomic Energy Agency, Vienna (Austria)). 1974. 100p. IAEA $5.00.

The aims of this program have mainly been to gain knowledge on the effects of time of application and nitrogen source on the crop's utilization of nitrogen. The experiments also included studies on placement of nitrogen and phosphate and on irrigation. Using ^{15}N- and ^{32}P-labelled fertilizers, nuclear techniques were demonstrated to be effectively used in research in practical agriculture. Results are presented of field experiments carried out over a four-year-period in 15 countries in Africa, Asia, Europe, and South America. (ERB)

11720 RADIOIMMUNOASSAY OF PARATHYROID HORMONE. Fujita, T. (Tokyo Univ.). Kotsu Taisha; 7: No. 2, 213-222(Apr 1974). (In Japanese).

For the radioimmunoassay of parathyroid hormone which is clinically important, the preparation of antibody, the preparation of ^{125}I and ^{131}I labeled hormone, antigen-antibody reaction, and the separation method of antigen-antibody complex are reported. The state of secretion of parathyroid hormone, i.e. the values of parathyroid hormone in the blood in the cases with hyperparathyriodism and hypoparathyroidism should be accurately understood is discussed. From these results, the clinical significance seemed to be evident. (JA)

11721 BONE SCINTIGRAPHY: COMPARISON OF ^{99m}Tc-POLYPHOSPHATE AND ^{99m}Tc-DIPHOSPHONATE. Serafini, A. D.; Watson, D. D.; Nelson, J. P.; Smoak, W. M. (Mount Sinai Medical Center, Miami Beach, FL). J. Nucl. Med.; 15: No. 12, 1101-1104(Dec 1974).

Eighteen patients were randomly administered either ^{99m}Tc-diphosphonate or ^{99m}Tc-polyphosphate and then restudied within 1 week using the alternative agent. Although both have a high affinity with bone, differences in their in vivo biologic behavior have been reported. These factors do not appear to be significant clinically in their sensitivity in detecting bone lesions although qualitative and quantitative differences in the bone scans were demonstrated. The presence of free technetium in the prepared product appears to be the most important factor contributing to these differences. (auth)

11722 PLACE OF ISOTOPE MYELOGRAPHY IN THE DEFINITION OF SPINAL CORD SWELLING FOLLOWING TRAUMA: AN EXPERIMENTAL STUDY. Yeo, J. D.; Collins, L. (Royal North Shore Hospital, Sydney). Aust. N. Z. J. Surg.; 44: No. 3, 292-298 (Jul 1974).

Isotope myelography is suggested as an efficient and suitable investigation for establishing if an absolute spinal block has occurred after spinal cord injury. The technique of using isotope myelography with a portable static detector for point counting along the spinal cord in sheep is described, and the results are compared with those obtained by contrast myelography. Under general anaesthesia six adult sheep were subjected to a reproducible contusion injury to the lower thoracic spinal cord (T10). Contrast and isotope myelography were used to investigate the development and duration of the spinal cord swelling that followed the trauma. (auth)

11723 SEPARATION AND RADIOIMMUNOASSAY OF Fα PROSTAGLANDINS USING SILICA GEL MICRO COLUMNS.

Hillier, K.; Dilley, S. R. (Oxford Univ.). Prostaglandins; 5: No. 2, 137-150(25 Jan 1974).

The use of micro columns of silica gel for the rapid separation of prostaglandins and a radioimmunoassay for the estimation of the Fα group is described. Silica gel micro columns achieved rapid flow rate and good resolution and recoveries of the A, E, and Fα groups of prostaglandins. Amniotic fluid levels of PGFα measured serially following injection of intraamniotic $PGF_{2}\alpha$ for the induction of abortion indicate approximately 50% reduction from peak levels in four to five hours. Concentrations remained higher than preinjection levels for at least twenty-four hours. (auth)

11724 LIVER SCANNING IN PATIENTS WITH SUSPECTED ABDOMINAL TUMOR. Fee, H. J. Jr.; Prokop, E. K.; Cameron, J. L.; Wagner, H. N. Jr. (Johns Hopkins Hospital, Baltimore). J. Amer. Med. Ass.; 230: No. 12, 1675-1677(Dec 1974).

Despite technical advances, the number of patients with hepatic metastases not visualized by ^{99m}Tc-sulfur colloid liver scanning remains high; more important, there is a significant incidence of false-positive reports. Preoperative scans of 70 patients with a high probability of abdominal tumor were compared with the incidence of hepatic metastases found at laparotomy. The overall accuracy of the liver scan was 84%; there were 13% false-positive and 23% false-negative results. Thus, the chance for error is too high to determine the existence of hepatic metastases on the results of liver scanning alone. (auth)

11725 RECENT FINDINGS OF RADIOIMMUNOASSAY FOR PARATHYROID HORMONE. Abe, M. (Iwate Medical Coll., Morioka, Japan). Kotsu Taisha; 7: No. 2, 195-201(Apr 1974). (In Japanese).

In order to improve the recent findings of radioimmunoassay for parathyroid hormone in the blood, the state of parathyroid hormone in the blood was biochemically studied. It was evident that it was produced as pro-parathyroid hormone in humans and cows. In addition, its chemical structure was decided, and the biological activity was examined. In the radioimmunoassay for human parathyroid hormone in the blood, the antigenicity of its antibody and the degree of the production of the parathyroid hormone in malignant tumors were examined. (JA)

11726 RADIOIMMUNOASSAY OF HUMAN PLASMA PARATHORMONE. Gueris, J. (Hospital Lariboisiere, Paris). Nouv. Presse Med.; 3: No. 25, 1612-1614(22 Jun 1974). (In French).

A radioimmunoassay of human plasma parathormone has been developed which allows parathormone to be detected in most normal subjects. It uses a heterogeneous system comprising a bovine parathormone tracer, a porcine parathormone antibody and a human standard. The use of a non-equilibrium method with delayed addition of tracer gives considerable improvement in the sensitivity of the assay. The separation of free and combined fractions is achieved with dextran-coated charcoal. The precipitate and supernatant are counted separately. Under these conditions the measured parathormone seems to correspond to the sum of the fraction circulating in the peripheral blood and reflects the state of parathyroid function. (FR)

11727 DETERMINATION OF GLOMERULAR FILTRATION RATE IN CHILDREN BY EXTERNAL MEASUREMENT OF THE DISAPPEARANCE OF 113m-INDIUM-DTPA IN PLASMA. Piepsz, A.; Erbsmann, F.; Vainsel, M.; Cantraine, F. (Univ., Brussels). Biomedicine; 20: No. 3, 192-197(May 1974).

A simple method for determining glomerular filtration, applicable to children and using the complex 113m-In-DTPA, is described. The use of this complex is justified and the reproducibility of the method and its correlation with the inulin clearance method is studied. The distribution of the results is studied to determine the threshold of normal values for the method. (FR)

11728 ROLE OF MULTI-ISOTOPE (^{67}Ga, ^{111}In, ^{99m}Tc) TUMOR LOCALIZATION IN CANCER MANAGEMENT. Weinstein, M. B.; Miale, A. Jr. (Univ. of Miami, FL). S. Med. J.; 67: No. 12, 1433-1439(Dec 1974).

From 67th annual scientific meeting; San Antonio, TX (11 Nov 1973).

Scintillation scanning techniques using certain newer radiotracer agents (gallium 67, indium 111, and technetium 99m) have been used in the diagnosis, staging, and management of over 350 cancer patients. This experience has demonstrated the unique capabilities of scintillation scanning in this role and has permitted some clarification as to the optimal use of single or multiple radiotracers. Our findings indicate the following: These methods are free of adverse reactions. Detection of metastases to various sites, especially bone, liver, and nodal areas, is improved substantially by scintiscanning. The site of an occult primary neoplasm or undiscovered metastasis sometimes can be found. Revision of the initial staging, treatment plan, and prognosis often may follow scanning examination. One must consider the limits of sensitivity of a given procedure, and regard negative results with great caution. The localization of pathophysiologic tissue responses may be similar in nonneoplastic and neoplastic diseases, which can lead to misinterpretation. The best possible management of a cancer population cannot be achieved if these techniques are excluded. (auth)

11729 MEASUREMENT OF PROSTAGLANDIN $F_{2}\alpha$ METABOLITES BY RADIOIMMUNOASSAY. Cornette, J. C.; Harrison, K. L.; Kirton, K. T. (Upjohn Co., Kalamazoo, MI). Prostaglandins; 5: No. 2, 164(25 Jan 1974).

Antibodies against 15 keto $PGF_{2}\alpha$ and 13,14 dihydro 15 keto $PGF_{2}\alpha$ were produced in goats and rabbits using the appropriate prostaglandin protein conjugate. Tritium labeled 15-keto, and 13,14 dihydro 15-keto $PGF_{2}\alpha$ were prepared from $^{3}H-PGF_{2}\alpha$. These antibodies and ^{3}H-labeled compounds were used to develop radioimmunoassays for the respective $F_{2}\alpha$ metabolites. The antibodies had relatively little cross-reactivity (≤0.1%) with the parent $F_{2}\alpha$ molecule. Infusion of $PGF_{2}\alpha$ in monkeys increased 15-keto-h_{2} levels 10-20 fold higher than $PGF_{2}\alpha$ in peripheral plasma. The levels of this metabolite were not altered detectably during clotting, indicating relatively slow rates of $PGF_{2}\alpha$ metabolism in vitro. These assays should be useful to follow release rates of exogenous prostaglandins from various formulations and delivery systems, and in vivo tissue synthesis of $PGF_{2}\alpha$, where low levels preclude measuring the parent compound. (auth)

11730 MEASUREMENT OF THE MYOCARDIAL FIXATION INDEX USING ^{131}Cs. First Results. de Vernejoul, P. (Hospital Necker-Enfants-Malades, Paris); Fauchet, M.; Mestan, J. Ann. Phys. Biol. Med.; 7: No. 4, 217-222(1973). (In French).

Measurement of the myocardial ^{131}Cs fixation index by external detection gives a quantitative estimate of the functional state of the myocardium cell. The physical characteristics of ^{131}Cs demand an exact measurement technique in order to express the results in percent of the dose injected per 100 g myocardium. The first results are reported. (FR)

11731 A RAPID PROCEDURE FOR THE RADIOIMMUNOASSAY OF RAT GROWTH HORMONE. Hervas, F.; Morreale de Escobar, G. (Consejo Superior de Investigaciones Cientificas, Madrid (Spain). Departamento de Endocrinologia Experimental). Horm. Metab. Res.; 6: No. 4, 300-303(Jul 1974).

4 figs.; 8 refs.

The radioimmunoassay for rat GH may be improved and the time required for its completion shortened by adding the labeled GH 6 hr after onset of a 24 hr incubation period at 37°C. Means and methods are described. (GE)

11732 DIFFERENTIAL DIAGNOSIS OF THE RENAL SCINTIGRAM. Suzaki, K.; Sakurai, T.; Moriya, H.; Hareyamam, M.; Tsutsuji, Y.; Fujieda, J.; Amino, I.; Omuro, H. (Sapporo National Hospital). Radioisotopes (Tokyo); 23: No. 3, 176-185(Mar 1974). (In Japanese).

Diagnostic approach was done in 92 cases with renal scintiscanning with ^{197}Hg-chlormerodrin. Especially, differential diagnosis in space occupying lesions such as renal tumor, renal cyst, renal tuberculosis, and metastatic retroperitoneal tumor was clinically analyzed. These diseases might have no characteristic pattern on the scintigrams, but some characteristic pictures were obtained in many cases. In addition, the scintigrams of other renal diseases were mentioned. Diagnostic significance was observed in not only space occupying lesion, but also malformation, renal insufficiency, and vascular diseases. As ^{197}Hg has low energy, it was safe in exposure dose, and there was no side effect. Scintigram is superior for resolution, and is applicable for side diagnostic method. However, over-estimation on diagnosis using this method should not be made. (auth)

11733 TESTS FOR LOCALIZATION OF TUMORS USING GAMMAGRAPHY. Distinction of Malignant Hepatic Tumors from Others with Selenite Ion (^{75}Se). Baptista, A. M. (Instituto Portugues de Oncologia de Francisco Gentil, Lisboa. Laboratorio de Isotopos de Abilio Lopes do Rego). Arq. Patol. (Lisbon); 45: No. 1, 27-71(1973). (In Portuguese).

40 figs.

After reference was made to recent work on gammagraphic localization of renal and pulmonary tumors results are presented of a study for the gammagraphic distinction of benign from malign hepatic tumors. After obtention of a liver gammagraphy with a radioactive suspension (^{198}Au or ^{99m}Tc) if present areas had no radioactivity (space occupying lesions) the test was repeated 48 to 72 hours after injection of sodium selenite (^{75}Se). It was hoped that if the space occupying lesion was a malignant tumor an up-

take of the selenite ion (^{75}Se) would be observed. On the contrary a cold area would remain cold if the tumor was a benign one. The results confirm the working hypothesis although the functional situation of the tumor (necrosis, for instance) could influence the distribution of the selenite. In other situations as in uterine cancer and renal tumors the method did not give identical hopes. However work in progress confirms an earlier study on the interest of an identical method for the study of bone tumors. (INIS)

11734 BONE SEEKING TECHNETIUM-99m STANNOUS PHOSPHATE COMPLEX. Adler, N.; Gamin, L. L. (to New England Nuclear Corp.). US Patent 3,852,414. 3 Dec 1974. Filed date 13 Sep 1972. 10p.

A metabolizable radioactive technetium-99m-stannous-ring phosphate complex in which at least 15 to 20% by weight, and perferably 40 to 100%, of the phosphate moiety is a ring or cyclic phosphate of molecular weight less than 300 and in which no more than 5 to 15% or 20% by weight of such phosphate moiety is a linear polyphosphate of molecular weight greater than pyrophosphate, a method of making the same, a method of using the same by in vivo intravenous administration to a mammal of the sterile-nonpyrogenic complex followed by radioassay scanning or imaging the skeletal structure, and a kit made up of a stannous-phosphate complex in which at least 15 to 20% and preferably 40 to 99% of the phosphate moiety is the aforesaid ring or cyclic phosphate and in which no more than 5 to 15% or 20% by weight of such phosphate moiety is a linear polyphosphate of molecular weight greater than pyrophosphate. (Official Gazette)

11735 RADIOIMMUNOASSAY FOR HUMAN ANTIHYDROGLOBULIN ANTIBODIES. II. Determination of Antigen-Binding Capacity. Salabe, G. B.; Salabe, H.; Dominici, R.; Davoli, C.; Andreoli, M. (Univ., Rome). J. Clin. Endocrinol. Metab.; 39: No. 6, 1125-1132(Dec 1974).

The radioimmunoassay using a double antibody technique has been developed to measure the total binding capacity (ABC) of serum antibodies for thyroglobulin (Tg). Serum is incubated with ^{125}I-radiolabeled thyroglobulin and then precipitated by sheep antihuman gamma globulin. The thyroglobulin binding capacity of serum antithyroglobulin antibody is measured on a saturation curve as the maximum mg bound per ml in the presence of increasing amounts of Tg. With this method it is possible to accurately and precisely measure ABC for Tg from 0.002 to several mg/ml serum. In a group of 88 adolescents with goiter and thyroiditis and in a group of 25 adults with chronic thyroiditis or primary myxedema, the ABC showed only partial correlation with other tests such as tanned red cell haemagglutination (TRC). In the diagnosis of thyroiditis the ABC technique, compared with TRC, was found to be not only more sensitive (80% positive, compared with 55% with TRC) but also more specific (with ABC 1 out of 59 of the normal adolescents was positive, whereas 17% gave a positive TRC). Studies carried out with rabbit anti-human IgM failed to detect IgM antibodies in almost all the cases. Determination of total thyroglobulin binding capacity of serum antibodies for Tg provides a quantitative and specific method to evaluate antibodies in both clinical and experimental work. (auth)

11736 RADIOACTIVITY SECRETED IN THE STOMACH CAVITY AFTER ^{125}I-LABELED SYNTHETIC HUMAN GASTRIN ADMINISTRATION TO RATS. Motoki, T.; Kato, Y.; Kamii, K.; Migita, T.; Kameda, H. (Tokyo Univ.). Radioisotopes (Tokyo); 23: No. 3, 196-197(Mar 1974).

Radioactivity secreted in the stomach cavity of rats following ^{125}I-labeled synthetic human gastrin injection was studied. It was considered to be caused by degradation products of ^{125}I-labeled gastrin, but its significance in the action mechanism of gastrin was not determined. (auth)

11737 BRAIN SCANNING WITH ^{99m}Tc-PERTECHNETATE. A Comparative Study in 2000 Cases. Klopper, J. F.; Rossouw, D. S.; van Heerden, P. D. P.; Malan, C.; Potgieter, J. (Stellenbosch Univ. (South Africa). Department of Diagnostic Radio-Isotopes, Pathology and Neurosurgery; Karl Bremer Hospital, Belville, C. P.). S. Afr. Med. J.; 47: 1792-1794(6 Oct 1973). 6 refs.

The results of 2213 consecutive brain scans were compared with those of cerebral angiography, electro-encephalography (EEG), lumbar puncture, air encephalography (AEG), and x-ray examinations of the skull. Positive brain scans were obtained in 82% of 160 cases with proved brain neoplasms, compared with 83% of 86 cases who had cerebral angiography. A positive yield of 92% was found in infected space-occupying lesions. Results were influenced by the anatomical position of the lesion, basal lesions being detected less often. (INIS)

11738 DEPOSITION OF ULTRAFINE AEROSOLS IN THE RESPIRATORY TRACT OF HUMAN VOLUNTEERS. Shanty, F. Baltimore; Johns Hopkins Univ. (1974). 99p. University Microfilms Order No. 74-29,031.

Thesis (Ph. D.).

A simple technique was developed for producing and sizing an 0.08 μm aerosol tagged with ^{99m}Tc, a gamma-emitting radioisotope with a half life of 6 hours. The test aerosol was reasonably monodisperse exhibiting geometric standard deviations in the range of 1.05 to 1.35. Hygroscopic growth of the test aerosol under conditions simulating humidification in the respiratory tract was measured. An apparatus was designed and constructed for use in conducting aerosol breathing studies. The experimental setup would also be suitable for use in lung scanning studies including regional deposition studies. Due to the observed solubility of the radioactive tracer, the aerosol in its present form is not recommended for use in clearance studies. Fractional deposition of the test aerosol was measured for both mouth breathing (in 2 test subjects) and nasal breathing (in 4 test subjects). Tidal volumes of approximately 500, 1000, 2000 ml and breathing rates of 9, 18, and 30 respirations per minute were used. For the same test subjects nasal breathing produced about 15% deposition; mouth breathing about 9%. These findings indicate that even for aerosols in the 0.1 μm size range, the nose may act as a significant barrier to aerosol penetration of the respiratory tract. Intra-nasal turbulence resulting in increased diffusional deposition is suggested as the mechanism. In general, changes in tidal volume produced a relatively small effect on fractional deposition. However, fractional deposition tended to increase more substantially when breathing rate was decreased from 30 to 9 respirations per minute. (Diss. Abstr. Int., B)

11739 DETERMINATION OF DIGOXIN BY RADIOIMMUNOASSAY AND ITS APPLICATION TO PEDIATRIC STUDIES. Krasula, R. W. Chicago; Univ. of Illinois (1973). 110p. University Microfilms Order No. 74-27,297.

Thesis (Ph. D.).

A highly sensitive and specific radioimmunoassay, which in one hour could measure digoxin in as little as 0.1 ml of serum, was developed and adapted to measure urinary and tissue concentrations. The use of this assay for studies of pediatric patients treated with digoxin for congestive heart failure has yielded data which will help to evaluate dosage requirements and toxicity in infants and children. The relatively larger doses of digoxin per unit body weight or surface area administered to pediatric patients, as compared to adults, resulted in significantly higher serum levels in infants under six months of age (1.7 vs. 1.0 and 1.1 ng/ml in children six months to two years and those over two years of age, respectively). Children over six months of age exhibited serum concentrations identical to those of adults. Additionally, young children (six months to two years old) excreted digoxin at a faster rate than those two to five years old, suggesting this as one cause for the increased dosage requirement. Infants and children receiving maintenance therapy who became toxic had higher mean serum digoxin levels than nontoxic patients (3.6 and 2.9 vs. 1.7 and 1.1 ng/ml), which should facilitate the diagnosis of digoxin toxicity (serum levels greater than 3 ng/ml being generally consistent with toxicity). Only a minimal amount of urinary digoxin had undergone biotransformation (2 to 5%). A study during open heart surgery with complete cardiopulmonary bypass found that children given a full digitalizing dose 1 to 5 days prior to surgery exhibited a higher incidence of arrhythmias (25% vs. 0%) and higher right atrial appendage digoxin concentrations (109 vs. 62 ng/g) than those on maintenance therapy for one month or longer. This study led to the following recommendations: prophylactic digitalization should be initiated with maintenance-sized doses at least two weeks before surgery, serum digoxin levels should be determined preoperatively to assure that they are within normal limits (1 to 2 ng/ml), additional digoxin should not be given for at least 12 hours following bypass, postoperative digoxin dosage should be modified in relation to the patient's creatinine clearance, and serum K^+ should be monitored and losses replaced during the first 12 hours postbypass. (Diss. Abstr. Int., B)

11740 DETECTION OF ANTITREPONEMAL ANTIBODIES IN SYPHILITIC SERA BY RADIOIMMUNOSORBENT TECHNIQUES. Mincey, E. K. Lafayette, IN; Purdue Univ. (1971). 181p. University Microfilms Order No. 74,26,665.

Thesis (Ph. D.).

The detection of specific antibodies in human serum by the use of specific immunosorbents and isotopically labeled immunological reagents has recently been developed as a diagnostic tool. The extension of this methodology to detection of antibodies arising from infection with microorganisms has not been made. This work seeks to apply the techniques of the radioimmunosorbent method to detect specifically the antibodies in syphilitic serum arising as a result of the infection. The method may have application in other infections with different organisms as well. Research was conducted with several solid-phase adsorbents in-

cluding polystyrene plastic tubes, microfine precipitated silica, and a cellulose conjugate. Over 500 tests were performed on 60 serum samples including a number from confirmed syphilitics and commercial syphilitic sera. A method using protein antigens derived from the Reiter treponeme and from Nichol's treponeme was developed. The antigens were adsorbed into microfine silica and the coated particles were used to adsorb specific antibodies from syphilitic sera. Detection of the specific adsorbed antibodies was by exposure of the silica-complex to a solution containing antihuman gamma globulin antibodies labeled with ^{125}I. Results of the radioimmunosorbent assays showed that antibodies in syphilitic sera could be detected by this method. Identical methods employing polystyrene plastic tubes showed potential value in this type of test using a model system as well as syphilitic sera. (Diss. Abstr. Int., B)

11741 IMPAIRED VENTILATION IN A PATIENT WITH ANGIOGRAPHICALLY DEMONSTRATED PULMONARY EMBOLI. Kessler, R. M.; McNeil, B. J. (Harvard Medical School, Boston). Radiology; 114: No. 1, 111-112(Jan 1975).

Matched regional ventilation/perfusion studies ($\dot{V}/\dot{Q}$) have traditionally been associated with ventilatory diseases, while mismatched $\dot{V}/\dot{Q}$ studies have been associated more often with vascular abnormalities. The authors describe a patient with multiple pulmonary emboli who demonstrated matched ventilation and perfusion studies five hours after the onset of symptoms on ^{99m}Tc-iron hydroxide particle scans. (auth)

11742 USE OF THE ^{99m}Tc-PERTECHNETATE NECK/THIGH RATIO AS A TEST OF THYROID FUNCTION. Selby, J. B.; Caldwell, J. G.; Magoun, S. E.; Beihn, R. M. (Veterans Administration Hospital, Lexington, KY). Radiology; 114: No. 1, 107-110 (Jan 1975).

From 14th annual meeting of the Southeastern Chapter of the Society of Nuclear Medicine; Memphis, TN (31 Oct 1973).

A total of 100 patients were studied by standard thyroid function tests and the ^{99m}Tc-pertechnetate neck/thigh ratio was determined. This ratio or trapping index correlated closely with ^{131}I uptake. The ^{99m}Tc test should be followed by scanning at 20 minutes to distinguish diffuse from localized thyroid disease. TSH stimulation and suppression studies can be done. It is recommended that this ratio be used in place of the standard 24-hour RAIU study, as it gives the same information at a saving in time, money, and radiation exposure. (auth)

11743 ATRAUMATIC EVALUATION OF MYOCARDIAL REVASCULARIZATION PROCEDURES WITH ^{43}K. Smith, R. O.; Bennett, K. R.; Suzuki, A.; Lehan, P. H.; Hellems, H. K. (Univ. of Mississippi, Jackson). Radiology; 114: No. 1, 99-106(Jan 1975).

Least-squares regression analysis was computerized to provide functional color images of ^{43}K myocardial perfusion patterns. In 8 of the 9 patients studied, changes in pattern indicated that the revascularization procedure speeded the appearance time and/or net rate of ^{43}K uptake. The functional images correlated well with coronary arteriograms made before and after surgery. This noninvasive isotope technique may prove to be clinically useful in evaluating coronary artery disease, defining the remaining viable myocardium when an aneurysm is present, and determining the effectiveness of the revascularization procedure. (auth)

11744 POSITRON-EMISSION TRANSAXIAL TOMOGRAPH FOR NUCLEAR IMAGING (PETT). Ter-Pogossian, M. M.; Phelps, M. E.; Hoffman, E. J.; Mullani, N. A. (Washington Univ., St. Louis). Radiology; 114: No. 1, 89-98 (Jan 1975).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL (1 Dec 1974).

An apparatus was developed for obtaining emission transaxial images of sections of organs containing positron-emitting radiopharmaceuticals (^{64}Cu, ^{15}O, ^{13}N, ^{11}C). The detection system is a hexagonal array of 24 NaI(Tl) detectors connected to coincidence circuits to achieve the "electronic" collimation of annihilation photons. The image is formed by a computer-applied algorithm which provides quantitative reconstruction of the distribution of activity. Computer simulations, phantom and animal studies show that this approach is capable of providing images of better contrast and resolution than are obtained with scintillation cameras. Advantages of positron vs. single photon reconstruction tomography are discussed. (auth)

11745 NEWER ASPECTS OF BRAIN SCANNING AT MOUNT SINAI. Lusins, J.; Klempner, W. (City Univ., New York). Mt. Sinai J. Med.; 41: No. 1, 166-171(1974).

The brain scan has become an integral part of the neurologic examination. The use of scanning is of value not only as an initial diagnostic tool but also to follow patients over months and years and to observe changes that have not been altered by surgical intervention. Recent developments in brain scanning using ^{99m}Tc as a tracer and some observations with the use of these newer techniques are presented. (CH)

MATERIALS

11746 (CONF-740562-) PROCEEDINGS OF THE GENERAL MEETING OF THE DANISH SOCIETY FOR THE PHYSICS AND CHEMISTRY OF CONDENSED MATTER, HELSINGOER, DENMARK, 23–25 May 1974. (Faststofselskabet, Copenhagen (Denmark)). 1974. 77p. Dep. NTIS (US Sales Only) $7.00.

From meeting of Danish Society for the Physics and Chemistry of Condensed Matter; Helsingoer, Denmark (23 May 1974).

Abstracts are presented of 39 papers arranged into sections dealing with surfaces, magnetism, radiation damage, superconductivity and metals, semiconductors and semimetals, ion bombardment, phonons, and phase transitions. (DLC)

11747 (COO-2126-18) TECHNICAL PROGRESS REPORT, SEPTEMBER 1, 1973–AUGUST 31, 1974. Solin, S. A. (Chicago Univ., Ill. (USA)). 1974. Contract AT(11-1)-2126. 7p. Dep. NTIS $4.00.

The vibrational and electronic properties of amorphous and crystalline solids and in some cases their gaseous and liquid counterparts have been studied using Raman spectroscopy, infrared spectroscopy, optical mixing, and high pressure uniaxial stress techniques. Included is data on GeAs, GeGa, Ge, arsenic sulfides, arsenic oxides, SiC, BN, and carbon. (JRD)

11748 (IS-3500) 1973 ANNUAL SUMMARY REPORT: HIGH ENERGY PHYSICS, NUCLEAR SCIENCES, MATERIALS SCIENCE, MOLECULAR SCIENCES. (Ames Lab., Iowa (USA)). Nov 1974. Contract W-7405-eng-82. 135p. Dep. NTIS $5.45.

This report consists of collections of abstracts of papers published during the previous calendar year in the areas of high-energy physics, nuclear sciences, materials science (including metallurgy and ceramics, solid state physics, and materials chemistry), and molecular sciences (including radiation and separations research, chemical and geophysical energy, molecular and atomic science, and mathematical and computer sciences. The emphasis is strongly on materials and molecular sciences. (RWR)

11749 (KFK-2054) PROGRESS REPORT OF THE TEIL-INSTITUT NUKLEARE FESTKOERPERPHYSIK, 1 JUNE 1973–31 MAY 1974. Schommers, W. (ed.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Sep 1974. 116p. (In German and English). Dep. NTIS (U. S. Sales Only) $9.00.

Research progress at the Teilinstitut Nukleare Festkörperphysik is summarized for the period from 1st June 1973 to 31st May 1974. The arrangement has been chosen to emphasize the main areas of research in which the institute is presently involved. These areas are dynamics of solids and liquids, electronic structure and magnetism of solids, and development of materials. Some of the technical developments relevant to these topics are also included. Besides the Reactor FR2 and the Cyclotron the major research facilities at the Kernforschungszentrum Karlsruhe, neutron beam facilities at the High Flux Reactor in Grenoble have been used for part of the work described. The institute supports also external users of the neutron beam facilities at the Reactor FR2. Descriptions of work done in cooperation with external groups are included in the report. The report contains only abstracts or references of those papers already published or in the process of publication. Preliminary results of work in progress are described more in detail. References to these results should be made only with the explicit permission of the authors. (auth)

11750 PROCEEDINGS OF THE SIXTH SYMPOSIUM ON THERMOPHYSICAL PROPERTIES, ATLANTA, GEORGIA, AUGUST 6–8, 1973. Liley, P. E. (ed.). New York; American Society of Mechanical Engineers (1973). 415p. (CONF-730851-). $24.50.

From 6th symposium on thermophysical properties; Atlanta, Georgia, USA (6 Aug 1973).

Forty-five papers were presented at the symposium on thermal conductivity of fluids, viscosity and diffusion, theoretical aspects, experimental investigations of theoretical properties, and fluids and liquid metals. A separate abstract was prepared for each of two papers selected for inclusion in NSA. (JRD)

For abstracts of individual papers see: 11991 and 11992.

Ceramics and Cermets

Refer also to abstracts 10646, 10686, 10687, 10792, 10807, 10813, 11866, 11917, 11924, 12080, 13147, 13168, 13384, and 13385.

11751 (AD-782398) METAL MATRIX COMPOSITES FOR HIGH TEMPERATURE TURBINE BLADES. Final Technical Report, 1 January 1973–31 March 1974. Brentnall, W. D.; Toth, I. J. (TRW, Inc., Cleveland, Ohio (USA)). 29 Apr 1974. Contract N00019-73-C-0202. 54p. (TRW-ER-7634-F). NTIS $3.75.

Results obtained during the first 12-month's work on a program to develop fiber-reinforced Fe–Cr–Al–Y composites for gas turbine applications at temperatures up to 2400°F are discussed. The feasibility of using a powder metallurgy method to fabricate monolayer and multi-ply specimens was demonstrated. Composites with W–1 ThO_2, Mo, TZM, SiC, and Al_2O_3 continuous filaments were evaluated. Evaluations included thermochemical compatibility studies on composites with uncoated and coated filaments and preliminary stress rupture strength determinations. (GRA)

11752 (CEA-CONF-2622) LIQUID PHASE HETEROEPITAXIAL GROWTH OF EuYGaIG AND BiCaVIG FILMS. Daval, J.; Geynet, J.; Challeton, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). Dec 1973. 16p. (CONF-730994-4). Dep. NTIS (US Sales Only) $4.00.

From conference on magnetic bubbles; London, England, UK (4 Sep 1973).

The heteroepitaxial growth of $Eu_{0.6}Y_{2.4}Ga_{1.2}Fe_{3.8}O_{12}$ is presented in terms of reproducibility and dispersion of the results. Also discussed is the original heteroepitaxy of $Bi_{3-2y}Ca_{2y}V_yFe_{5-y}O_{12}$ films grown by LPE technique using excess of Bi_2O_3 or Bi_2O_3 + PbO as solvants, on Czochralski-grown neodymium gallium garnet substrates. (8 fig) (auth)

11753 (CONF-741002-P2, pp 538-549) TENSIMETRIC STUDY OF PHASE REACTIONS IN THE BINARY RARE EARTH OXIDES: CHEMICAL HYSTERESIS. Lowe, A. T.; Lau, K. H.; Eyring, L. (Arizona State Univ., Tempe). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Results of the study show that intrinsic chemical hysteresis appears to occur in all two-phase regions of the PrO_x or TbO_x – O_2 systems. Pseudophase formation is also present in the two-phase regions and is most marked in the direction of decreased symmetry. Chemical hysteresis is less marked during slow rates of temperature change in low temperature loops while pseudophase behavior is unaffected above about 300°C. Coarse crystalline samples of both PrO_x and TbO_x show dramatic reduction of both chemical hysteresis and pseudophase formation in all two-phase regions where the temperature is high enough to remove the longer diffusion path for oxygen as the cause of slow reaction. When crystalline samples were ground to powder the hysteresis and pseudophase properties returned. (auth)

11754 (CONF-741002-P2, pp 559-567) INVESTIGATIONS ON EuO SINGLE CRYSTAL: CRYSTAL GROWTH, TRANSPORT PROPERTIES AND MODEL. Godart, C.; Percheron, A.; Achard, J. C.; Llinares, C.; Desfours, J. P.; Nadal, J. P. 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In Proceedings of the 11th rare earth research conference.

Two types of samples were studied; A type with insulator–metal transition (IMT) and B type without IMT. In order to explain the two types observed, a model is proposed with an acceptor level whose density corresponds to impurity concentration of the samples used and two donors levels, one strongly bound to the conduction band, the other responsible to the IMT. It was observed that an increase either of the cooling rate, or of the Eu excess, gives the same effect on the resistivity behavior. After different annealing of these samples, it is possible to determine what kind of level is responsible for the transition. Moreover the effect of hydrostatic pressure and uniaxial stress on resistivity allows determination of the position of this level in relation to minimum of the conduction band. (auth)

11755 (CONF-741002-P2, pp 568-577) FORMATION OF UNUSUAL GLASSES BASED ON Ln_2O_3. Yajima, S.; Okamura, K.; Shishido, T. (Tohoku Univ., Japan). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Glassy phases of Ln_2O_3 systems with non-lanthanide oxides were prepared using a high-rate quenching process. The rapid

quenching devices used in the investigation are described along with results of studies on several binary oxide systems. (JRD)

11756 (CONF-741002-P2, pp 578-587) SUPERPOSITION MODEL ANALYSIS OF THE BEHAVIOR OF Er^{3+} IN THE ZIRCON-STRUCTURE SYSTEMS. Vishwamittar; Puri, S. P. (Punjab Agricultural Univ., India). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Symmetry parameters for Er^{3+} doped $YAsO_4$, YPO_4, YVO_4, and $ScVO_4$ systems were studied. A superposition model is used to show that a local field superposition approximation is reliably accurate for the sixth-order parameters. (JRD)

11757 (CONF-741002-P2, pp 593-601) THEORETICAL STUDY OF SmS. Iglesias-Sicardi, J. R. (Univ. del Sur, Bahia Blanca, Argentina); Bhattacharjee, A. K.; Tournier, R.; Jullien, R.; Coqblin, B. 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

A simple model based on the resonant scattering theory is used to explain the first-order semiconductor-to-metal transition accompanied by a valence change in SmS. (auth)

11758 (CONF-741002-P2, pp 1077-1086) HEATS OF THE TETRAGONAL-CUBIC TRANSFORMATION IN RARE EARTH DICARBIDES AND MIXED RARE EARTH DICARBIDE SOLID SOLUTIONS. Adachi, G.; Shiokawa, J. (Osaka Univ.). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Studies devoted to determination of heats of transformation in these systems are reported. Information is included on sample preparation, and experimental results. (JRD)

11759 (GEAP-12533) THERMODYNAMIC DATA PROGRAM INVOLVING PLUTONIA AND URANIA AT HIGH TEMPERATURES. Quarterly Report No. 28, May 1, 1974–July 31, 1974. Adamson, M. G.; Aitken, E. A. (General Electric Co., Pleasanton, Calif. (USA). Vallecitos Nuclear Center). Aug 1974. Contract AT(04-3)-893. 40p. Dep. NTIS $5.00.

Progress is reported on the continuing scope of work related to fission product-cladding chemical interaction, sodium-fuel interaction, and oxygen and plutonium–uranium redistribution in temperature gradients. The objective of Task 1 is to delineate the conditions for intergranular attack of Type-316 stainless steel caused by fission-product buildup in LMFBR fuel elements. The objective of Task 2 is to delineate the conditions and the behavior of the sodium-fuel reaction in the event of a defected fuel pin. The objective of Task 3 is to delineate the oxygen and actinide redistribution processes to understand the degree of component transport induced by a temperature gradient and the effects of this transport on the properties of the fuel element systems. (MCW)

11760 (ICP-1056, pp 24-26) ELECTRODEPOSITION OF THORIUM OXIDE ON TUNGSTEN–THORIUM AND TUNGSTEN–RHENIUM WIRES FOR ULTRASONIC THERMOMETERS. Olehy, D. A. Oct 1974.

In Analytical Chemistry Branch annual report, fiscal year 1974.

A research project on coating very thin tungsten–thorium and tungsten–rhenium wires with thorium oxide was initiated. These wires are to be used as ultrasonic thermometers to measure the very high temperatures in various parts of the PBF reactor. The problem encountered with using uncoated wires is that the wire tips vaporize with the vapor migrating and recondensing on the cooler portion near the insertion orifice. The wire is thickened, thus, preventing withdrawal of the wires from the reactor. Also, the changes in wire cause an interference with the ultrasonic signal. The wires were coated with thorium oxide by electrodeposition and the oxide was sintered on the wire. (WHK)

11761 (JINR-P12-8096) RELEASE OF NUCLEAR REACTION PRODUCTS FROM THORIUM OXIDE. Reetz, T.; Aikhler, B.; Baier, G. Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The fractional release of nuclear reaction products from sintered thorium oxide was investigated over the temperature range 1350 to 1800°C. It was shown that the rate of release depends on the ionic radius of the diffusing impurity ions and on the free enthalpy of its oxides. The effective diffusion coefficients of the products in thorium oxide decrease in the following order: Se > Ag > Te, Rb, Be > Sb, Cs > Bi, Pb > J > Ra > In > Nb. (auth)

11762 (JUL-1079-RB-RW) METHOD OF INTEGRAL VALUES FOR MEASURING THE HEAT CONDUCTIVITY AND OTHER PARAMETER OF MATERIALS UP TO TEMPERATURES OF 2000 KELVIN. Neumann, M. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Jun 1974. 122p. (In German). Dep. NTIS (US Sales Only) $9.25.

Thesis. Submitted to Technische Hochschule, Aachen.

For the development of new reactor materials and nuclear fuels it is important to measure the heat conductivity of the materials up to high temperatures. Performing the measurements several difficulties arise. A method which can be used to avoid most of the measuring problems has been developed and used to measure the heat conductivity of graphite and uranium carbonitrides. The method is based on measuring a set of integral values of the heat conductivity over relatively large temperature intervals and on evaluating the temperature curve of the heat conductivity by a computer program. Further parameters of the materials as electrical conductivity and thermal expansion can be measured simultaneously. (auth)

11763 (JUL-1081-RW) CONTRIBUTION TO THE U_2C_3 FORMATION BY THE SYNTHETIC REACTION AND BY THE DECOMPOSITION OF UC_2. Buschinelli, A. J. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jun 1974. 147p. (In German). Dep. NTIS (US Sales Only) $10.50.

Thesis. Submitted to Technische Hochschule, Aachen.

Influences of mechanical and thermal pretreatments on reaction kinetics were investigated and discussed taking the literature into account. The relative increasing of the U_2C_3 nucleation rate due to the pulverization corresponds approximately to the surface enlargement of the pulverized material. Activation energy for the synthetic reaction in powder was found to be 94 ± 7 kcal/mol. The negative influence of nitrogen, oxygen, and tungsten on the U_2C_3 formation is reported. In the decomposition of UC_2 to U_2C_3 and graphite, influences of the morphology of the graphite precipitate and the fast neutron irradiation on the beginning of the U_2C_3 formation were also investigated. (114 references, 44 fig, 11 tables) (auth)

11764 (JUL-1086-RW) DEVELOPMENT OF A DIFFERENTIAL-THERMAL-ANALYSIS FOR THE INVESTIGATION OF THE PYROLYSIS OF PHENOLIC-FORMALDEHYDE RESINS. von Dobschuetz, P. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1974. 110p. (In German). Dep. NTIS (U. S. Sales Only) $8.50.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

A contribution is presented for the optimization of matrix material for fuel elements of high temperature reactors aiming to develop micro-differential-thermo-analysis equipment capable of heating small samples up to 800°C without access of oxygen. High selectivity and sensibility was required. By means of this equipment three types of novolac and resol resins, which are used as binder for the graphite components of matrix, with different ratios of phenol/formaldehyde were investigated, hence a contribution to the explanation of the mechanism of pyrolysis of these resins can be given. (auth)

11765 (MLM-2181(OP)) SAMPLE PREPARATION AND ANALYSIS OF LARGE $^{238}PuO_2$ AND ThO_2 SPHERES. Wise, R. L.; Selle, J. E. (Mound Lab., Miamisburg, Ohio (USA)). [nd]. Contract AT-33-1-GEN-53. 19p. (CONF-740812-5). Dep. NTIS $4.00.

From 7th annual international Metallographic Society technical conference; Gatlinburg, Tennessee, USA (4 Aug 1974).

Techniques for determining the density distribution in $^{238}PuO_2$ and ThO_2 spheres are described. A sphere is sectioned through its center, parallel to its polar axis and mounted in a metallographic mount. After the sample is ground and polished, it is examined on a quantitative image analyzer. Since plutonium-238 is extremely alpha active and toxic, it is necessary to mount the microscope and television camera of the quantitative image analyzer inside a glovebox. (auth)

11766 (ORNL-TM-4673) MEASUREMENT AND CONTROL OF THE SHAPE OF FUEL PARTICLES FOR HIGH-TEMPERATURE GAS-COOLED REACTORS. Lackey, W. J.; Pechin, W. H.; Sease, J. D. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 22p. Dep. NTIS $4.00.

A rapid and meaningful technique for measuring the shape or out-of-roundness of coated fuel microspheres was developed. The index of merit is termed "shape ratio" and is defined as the coating thickness on one side of a particle divided by the thickness on the opposite side. More nearly spherical particles were obtained by coating in smaller charges, at higher propylene flow rates, at lower temperatures, and with a porous plate rather than a single-inlet cone used as the gas distributor for the fluidized bed. (auth)

11767 (ORNL-tr-2873) HIGH-MELTING METAL-CERAMIC EUTECTICS. Claussen, N.; Petzow, G.; Jahn, J. (Max-Planck-Institut fuer Metallforschung, Stuttgart (F.R. Germany). Inst. fuer Werkstoffwissenschaften). 1974. Translation by C. B. Finch of Hochschmelzende Metallkeramik- Eutektika. 30p. Dep. NTIS $4.50.

The fracture properties of a series of high-melting metal ceramic eutectics (MCE), in which the metal phase is incorporated as thin (~1 μ) fibers, were studied by 3-point bending and the electron microscope. It evolved that the K_{IC} values about correspond to those of the matrix; however, the work of fracture many times exceeds that of the pure ceramic. For the hot-pressed Cr_2O_3–Mo samples, the K_{IC} factor is above that of Cr_2O_3, and probably also is the static bending strength. The origin of the quasi-ductile properties of MCE is principally the result of the plastic deformation of the Cr and Mo fibers. But other mechanisms absorbing the fracture energy, i.e., releasing and extracting are also responsible for the high work of fracture in the case of brittle Ta and W needles. Macroscopic, nondirected samples with isotropic fracture properties can be prepared by hot pressing eutectic grains. The respective values for the K_{IC} factor and the work of fracture are above those of the melted MCE, and exhibit considerably less scatter. (auth)

11768 (UCID-16626) DT FUSION NEUTRON IRRADIATION OF SLL SYNTHETIC-FUSED QUARTZ. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Oct 1974. Contract W-7405-eng-48. 4p. Dep. NTIS $4.00.

Irradiation of synthetic-fused quartz in a fusion neutron beam for 40 h is reported. Data on the average neutron fluence as calculated from Nb foil dosimeters is tabulated. (JRD)

11769 ENTHALPY AND SPECIFIC HEAT OF YTTRIUM OXIDE AT 1300 TO 2100°K. Landa, Ya. A.; Polonskii, Yu. A.; Glazachev, B. S.; Milovidova, T. V. (All-Union Inst. of Refractories, Moscow). Refractories (USSR) (Engl. Transl.); 15: No. 1-2, 86-88(1974).

Translated from Ogneupory; 15: No. 2, 16-18(Feb 1974).

The temperature dependence of the enthalpy and heat capacity of Y_2O_3 over the range 1300 to 2100°K was determined by a combination of experimental and analytical methods. The equation obtained can be interpolated in a first approximation for the temperature range 298-1300°K. (auth)

11770 GRAIN-STRUCTURED THERMOSTABLE REFRACTORIES FROM ZrO_2 STABILIZED WITH CaO. Karaulov, A. G. (Scientific-Research Inst. for Refractories, Kiev). Refractories (USSR) (Engl. Transl.); 15: No. 1-2, 47-54(1974).

Translated from Ogneupory; 15: No. 1, 43-50(Jan 1974).

The most effective method of increasing the spalling resistance of ZrO_2 refractories consists of adding unfired monoclinic ZrO_2 to the body. The determining factor is the phase composition of the fired product which depends mainly on the proportion of added stabilizing CaO. The optimum phase proportion for producing an elastic structure with microcracks is 20 to 40% monoclinic and 60 to 80% cubic ZrO_2 phases. The grain size distribution of the body, molding pressure, and firing conditions are other factors contributing to the spalling resistance of the finished product. An analysis was carried out of the influence of these factors also on the strength and gas permeability of the product. Conditions were found for the production of spalling-resistant refractories from granular zirconium dioxide bodies. Tests under service conditions demonstrated the high spalling resistance of the refractories produced by the proposed method compared with the refractories produced by an earlier technology. (8 fig, 2 tables) (auth)

11771 ZIRCONIA FIBRES. Morton, M. J.; Birchall, J. D.; Cassidy, J. E. (to Imperial Chemical Industries Ltd.). British Patent 1,360,198. 17 Jul 1974. 5p.

A description is given of a fabrication process applied to ZrO_2 fibers containing Al_2O_3 and Y_2O_3. The fiberizing material contains Zr, Al, and Y compounds. A process comprising heating the fiber is included, the heating resulting in the formation of a fiber comprising Al_2O_3, ZrO_2, and Y_2O_3 as refractory oxides, that can be sintered if desired. The Al_2O_3 can be employed as grain growth inhibitor, and the Y_2O_3 as a phase change stabilizer. The fibers may be size coated with polyvinyl alcohol or stearic acid. They may also be immersed in ethyl silicate solution, washed, and heated to give fibers containing SiO_2, or soaked in solutions of metal salts and heated to give fibers containing additional refractory metal oxides. A continuous, discontinuous or felted fiber may be produced in which the ZrO_2 is in tetragonal or cubic form. Catalytic materials may be included in or on the fiber; methods for such incorporation are described, and a list of suitable catalyst materials and their applications is given. (UK)

11772 EFFECT OF GROWTH RATE ON ANODICALLY FORMED ZIRCONIUM OXIDE FILMS. Howes, V. R. (Univ. of Nottingham, Eng.). Corros. Sci.; 14: No. 8, 491-502(Sep 1974).

Anodic oxide films were grown on zirconium at constant current densities for a range of current densities extending over several orders of magnitude. Optical and scanning electron microscopy show structural differences for different current densities and the mechanical failure of the films was studies by tensile testing after oxidation. As the current density was reduced, blistering and breaking of the oxide layer was found to increase and this is associated with anomalies in the experimental voltage-time graphs. The relationship between electric field in the oxide and the current density was investigated and values of the activation energies of diffusion were estimated for oxygen ions and zirconium ions. Possible mechanisms are dicussed for the stress relaxation found to occur increasingly for current densities from 0.01 to 1 mA cm^{-2}. (auth)

11773 REFRACTORY CARBIDES. Samsonov, G. V. (ed.). Studies in Soviet Science. New York; Plenum Publishing Corporation (1974). 471p. $50.00.

Translated from Russian by Noel B. Vaughan.

The collection of fifty-five papers contains the results of recent investigations into methods of producing high-purity carbides and components made of the carbides and their alloy systems. The electric, thermophysical, thermodynamic, mechanical, and chemical properties, and the utilization of the carbides as wear- and abrasion-resistant materials are included. Abstracts are prepared for forty-seven chapters in-scope for NSA. (MCW)

For abstracts of individual chapters see: 11774–11820.

11774 SOME PROBLEMS IN THE THEORY OF THE PROPERTIES OF CARBIDES. Samsonov, G. V. pp 1-11 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Features of the electron structure of carbides of d-transition metals are discussed in terms of the configuration-localization model. It is shown that the factors which mainly determine the level of the properties of carbides are the statistical weight of the carbon atoms with sp^3-configurations, the localization of electrons in the d^6-configuration, and the concentration of excess nonlocalized electrons in the carbide lattice. (auth)

11775 METHODS OF PRODUCING PURE CARBIDES. Kosolapova, T. Ya.; Makarenko, G. N. pp 15-21 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Methods of producing refractory carbides are classified in a diagram. The most widely used methods of carbide production are by synthesis from the elements and by carbothermic reduction of the oxides. The formation of carbides is discussed from the point of view of the electron structure of the metals and carbon composing them, and also from that of a configuration-localization model that is presented. (auth)

11776 PRODUCTION TECHNOLOGY AND SOME PROPERTIES OF THE PYROLYTIC CARBIDES OF ZIRCONIUM AND TITANIUM. Davydov, V. S.; Ermakov, B. G.; Sokolov, V. V. pp 23-29 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A study was made of the conditions necessary for the production of dense deposits, uniform in composition, of titanium and zirconium carbides by deposition from a gaseous mixture. Optimum conditions were determined for depositing these carbides from a gaseous phase containing the vapor of the higher chloride of the metal, methane, and hydrogen. The effect of various parameters of the process (temperature, composition of the gaseous phase, and rate of supply of the vapor mixture) on the rate of deposition, structure, and chemical composition of the carbides obtained is discussed. (auth)

11777 INVESTIGATION OF A METHOD OF OBTAINING NIOBIUM CARBIDE POWDER AND COATINGS FROM THE VAPOR PHASE. Lyudvinskaya, T. A.; Sinel'nikova, V. S.; Kosolapova, T. Ya.; Sergeev, V. P. pp 39-46 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The possibility of obtaining niobium carbide in the form of powder and coatings by deposition from a vapor mixture in the temperature range 1500-1900°C was investigated. The rate of deposition was studied in relation to the concentration of the reagents, the substrate temperature, and the rate of hydrogen supply. The highest deposition rate for niobium carbide was found to occur at an optimum ratio of hydrogen to total chlorides of 10 : 1. The possibility of depositing coatings on graphite, tungsten, molybdenum, and niobium was also investigated. (auth)

11778 PRODUCTION AND SOME PROPERTIES OF CARBOHYDRIDES OF TITANIUM, VANADIUM, AND NIOBIUM. Antonova, M. M.; Bazhenova, L. N.; Timofeeva, I. I. pp 47-57 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

An investigation of the structure and certain properties of the carbohydrides of transition metals belonging to groups IV and V has enabled preliminary conclusions to be drawn regarding the effect of features of the electron structure of the d-metals on the nature of the interaction between the components. (auth)

11779 NEW METHODS OF COMMINUTING POWDERS OF REFRACTORY-METAL CARBIDES. Gurevich, B. D.; Nezhevenko, L. B.; Groshev, V. I.; Gudovich, A. P. pp 59-66 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The optimum conditions for comminuting zirconium carbide by means of ultrasound and by using a planetary centrifugal mill were determined. The use of ultrasound leads to the production of powder having spherical particles with a high degree of dispersivity and containing only a small amount of ground impurities. To reduce the impurities ground from the surface of the planetary centrifugal mill during comminution, it is proposed that a zirconium carbide lining to the mill be used. (auth)

11780 FUNDAMENTAL ASPECTS OF THE COMPACTION OF CARBIDES. Struk, L. I. pp 69-78 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The compaction of powders of the carbides of Ti, Zr, Nb, Cr, Mo, and W was investigated. The following aspects of compaction were studied: the dependence of the density of the compacted samples on the pressure and the number of successive compacting operations; the effect of the time during which the powder remained under load on the compactability of refractory-compound powders; the force distribution during compaction and the ejection pressure; the effect of the charge and the plasticizer content on compactability; and the dependence of the elastic aftereffect on the compaction pressure. (auth)

11781 PRODUCING HIGH-POROSITY MATERIALS FROM TRANSITION-METAL CARBIDES. Samsonov, G. V.; Vitryanyuk, V. K. pp 79-88 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The conditions for producing materials with a porosity of 68 to 74% combined with satisfactory mechanical strength were studied. The effect of additions of prepared carbides, zirconium powder, and particle size on the strength of the finished highly porous components were determined. (auth)

11782 EFFECT OF THE CONDITIONS OF PRODUCING CARBIDE POWDER ON THE PROPERTIES OF SINTERED SPECIMENS. Nezhevenko, L. B.; Groshev, V. I.; Gurevich, B. D.; Bokov, O. V. pp 89-95 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The effect of the content of incompletely reduced oxides on the sinterability of components made of zirconium carbide powders was investigated. It was found that increasing the oxygen content in ZrC powders from 0.2 to 7 wt % reduces the rate of grain growth in the finished components and promotes stabilization of the grain size. A method for producing high-density ZrC specimens was developed. (auth)

11783 VACUUM CARBIDIZATION OF TRANSITION METALS OF GROUPS IV AND V. Zhunkovskii, G. L. pp 107-115 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The carbidization in vacuum of transition metals of groups IV and V was investigated. A relationship was established between the thickness of the coatings formed and the pressure, temperature, and time of impregnation; the optimum temperatures for producing dense, pore-free layers that are well bonded to the substrate were determined. The two-phase nature of the structure of coatings on group V metals was demonstrated, and a proportionality was found between the thickness of the phases and the width of the phase regions in the constitutional diagrams. (auth)

11784 SOME PROBLEMS IN THE THERMODYNAMICS AND KINETICS OF THE FORMATION OF CARBIDE COATINGS ON GRAPHITE FROM THE VAPOR PHASE. Emyashev, A. V.; Chernenkov, I. I.; Panshin, L. N. pp 117-123 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Thermodynamic calculations for the systems Si–Cl–C–H and Zr–Cl–C–H in the course of carbide formation were made on an electronic computer. The kinetics of formation of the carbides SiC and ZrC were studied experimentally in the temperature ranges 1400 to 1700°K and 1500 to 2400°K. The data calculated on a thermodynamic basis and the experimental results on the kinetics of the process were compared, and it was found that with a supply of the necessary components from the vapor phase the carbide coatings grow at a constant rate up to large thicknesses. (auth)

11785 STUDY OF THE SOLDERING OF GRAPHITE MATERIALS WITH THE FORMATION OF A CARBIDE LAYER. Anikin, L. T.; Kravetskii, G. A. pp 133-140 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Aspects of the carbidization that occurs during the soldering of graphite by means of zirconium and molybdenum foil were studied. Optimum soldering conditions—a temperature of 2200°C and a holding time of not less than 3 min—were determined. Under these optimum conditions the strength of the soldered joint is not less than that of the base material. (auth)

11786 PHASE DIAGRAM OF THE SYSTEM TITANIUM–MOLYBDENUM–CARBON. Eremenko, V. N.; Velikanova, T. Ya.; Shabanova, S. V. pp 143-155 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The phase diagram of the boundary system Mo–C was redetermined at high carbon contents. A higher carbide of molybdenum (cubic, NaCl type of lattice, homogeneity range 37 to 40 at. % C) was found to form by a peritectic reaction at 2560°C; at 2000 to 2200°C this undergoes a polymorphic transformation into the low-temperature hexagonal form, which subsequently, at 1630°C, decomposes into the lower carbide and carbon. A phase transformation occurs in the lower carbide of molybdenum at 1170°C. The phase diagram of the ternary Ti–Mo–C system was determined. Its principal features are: the system is divided into two triangles by the Mo–TiC section; the cubic carbides of molybdenum and titanium form a continuous series of solid solutions; at low temperatures titanium stabilizes the phase based on the higher hexagonal carbide of molybdenum. (auth)

11787 STUDY OF THE PHASE EQUILIBRIA IN THE SYSTEM TANTALUM–VANADIUM–CARBON IN THE RANGE 0 TO 33 AT. % C. Tret'yachenko, L. A.; Komarova, S. A.; Eremenko, V. N. pp 157-163 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The phase equilibria in the system Ta–V–C were investigated at 1600°C in the range from 0 to 33 at. % C, and a projection of the solidus surface in this range was constructed. It was found that in the region investigated the ternary system Ta–V–C is characterized by the existence of equilibrium between the carbide solid solutions $(Ta,V)_2C_{1-x}$ and the metallic phase based on the Ta–V solid solutions. The carbide phase is richer in tantalum than the metallic phase coexisting with it. The change in the lattice parameters in the continuous series of solid solutions $(Ta,V)_2C_{1-x}$ was determined. (auth)

11788 NbC–Re POLYTHERMAL SECTION IN THE NIOBIUM–RHENIUM–CARBON SYSTEM. Vil'k, Yu. N.; Ordan'yan, S. S.; Murav'ev, A. A.; Miroshnichenko, A. G.; Omel'chenko, Yu. A. pp 165-171 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The structure of the NbC–Re polythermal section of the Nb–Re–C system was investigated by the x-ray, metallographic, and chemical methods of analysis and by making microhardness and melting-point measurements. It was found that the NbC–Re system is of the eutectic type, with the eutectic point at 2225 ± 15°C, 70 at. % Re, and that the solubility of rhenium in NbC is small, being 1.5 at. % at 2000 to 2100°C. The ($\delta + \beta$) field extends to 96 to 98 at. % Re. The lattice parameter of the δ-phase in the δ and ($\delta + \beta$) fields as a function of its rhenium content decreases from 4.470 Å (the value given in the literature) to 4.469 Å at 2000 to 2100°C. The microhardness of the δ-phase is related to the solid solution of rhenium in NbC and that of the β-phase to the solid solution of carbon in rhenium. (auth)

11789 X-RAY SPECTRAL STUDY OF SOME COMPOUNDS OF NIOBIUM AND CARBON. Korsunskii, M. I.; Genkin, Ya. E.; Lifshits, V. G. pp 175-178 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The emission spectra of the niobium carbides $NbC_{0.86}$, $NbC_{0.93}$, and $NbC_{0.98}$ were investigated. An increase in the intensity of the second region of the band and a decrease in that of the short-wave region were observed. This is due to an increase in the number of local Nb–C bonds with rise in carbon concentration. The concentration of collective electrons varies only slightly, being 2.7 to 3.6×10^{22} cm^{-3}. It is concluded that there is a reduction in the weight of d-states in the wave functions of the collective electrons as compared with pure niobium and that the value is 0.5 to 0.66. (auth)

11790 STATE OF THE CARBON ATOM IN TRANSITION-METAL CARBIDES. Zhurakovskii, E. A.; Vasilenko, N. N. pp 179-185 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The K_α band of carbon in carbides of the transition metals of groups IV, V, and VI and in diamond and graphite was measured by means of an ultralong-wave x-ray spectrometer with diffraction grating. The width of this band in the carbide spectra was considerably less than in pure carbon, and there was no fine structure. In all of the carbides there is a chemical shift of the CK_α band in the short-wave direction relative to its position in graphite, amounting on average to 1.5 to 2.0 eV. In relation to the position in diamond this shift is computed to be a few tenths of an electron volt and it takes place in the long-wave direction. From the analysis of the spectra and a comparison of them with data based on theoretical calculations and physical properties, a number of conclusions are drawn in regard to the state of the carbon atom in refractory carbides, the nature of its interaction with the valence band of the b-metals, and the magnitude and direction of charge transfer in the carbides. (auth)

11791 SOFT X-RAY SPECTRA OF VANADIUM CARBIDES IN THE HOMOGENEITY RANGE. Zhurakovskii, E. A.; Dzeganovskii, V. P.; Bondarenko, T. N. pp 201-208 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The L spectra of vanadium and the K_α band of carbon in the homogeneity ranges of the vanadium carbides V_2C and VC were measured on an RSM-500 ultralong-wave spectrometer. The results are compared with previously obtained emission and absorption K spectra of vanadium in carbides, and the results of quantum-mechanical calculations on isomorphous titanium carbides are included. The existence of a three-band energy structure of the valence band is shown, reflecting the metallic-covalent-ionic nature of the chemical bond in the carbides. Conclusions are drawn regarding the direction of charge transfer, and an energy diagram is proposed for $VC_{0.688}$. (auth)

11792 EFFECT OF NEUTRON IRRADIATION ON THE STRUCTURE OF TITANIUM AND CHROMIUM CARBIDES. Koval'chenko, M. S.; Ogorodnikov, V. V.; Krainii, A. G.; Ochkas, L. F. pp 209-220 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

An x-ray study was made of the change in lattice parameters of TiC and Cr_7C_3 irradiated in a reactor with integrated neutron fluxes of 10^{16}, 10^{18}, and 10^{20} neutrons/cm^2. The broadening of the lines on the diffraction patterns of annealed, hot-compacted, and irradiated specimens was investigated by means of harmonic analysis. The effect of compression on the change in lattice parameter of the irradiated carbides was also investigated. Analysis of the possible positions of the displaced atoms showed that the stable defect configuration in TiC is a dumbbell in the ⟨111⟩ direction. The energy stored in the form of static lattice distortions was calculated from the change in volume of the unit cell on irradiation. (auth)

11793 SOME PHYSICAL PROPERTIES OF PYROLYTIC BORON CARBIDE. Neshpor, V. S.; Nikitin, V. P.; Rabotnov, V. V. pp 221-229 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The specific electrical resistivity, absolute differential thermo-emf, Hall coefficient, thermal conductivity, and microhardness were measured on specimens of pyrolytic boron carbide having theoretical density and a compact laminar-columnar structure. It is suggested that the p-conduction in boron carbide is due to the partial replacement of carbon atoms in boron carbide of the limiting composition B_4C by boron atoms that have a lower valence. (auth)

11794 EMISSIVE POWER AND SPECIFIC ELECTRICAL RESISTIVITY OF ZIRCONIUM AND NIOBIUM CARBIDES AT HIGH TEMPERATURES. Petrov, V. A.; Chekhovskoi, V. Ya.; Sheindlin, A. E.; Kashekhlebova, I. L.; Nikolaeva, V. A.; Fomina, L. P. pp 231-238 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The emissive power and specific electrical resistivity of zirconium and niobium carbides were investigated in vacuum and in argon at temperatures up to 3300 to 3500°K. The existence of an initial section on the curve for the $E_t(T)$ relationship is demonstrated in the case of both carbides. It is suggested that this is due to the oxidized condition of the surface. The deviation of the $\rho(T)$ relationship from a straight line above 2750°K in the case of niobium carbide is attributed to the incongruent evaporation of this carbide. (auth)

11795 VARIATION IN THE LATTICE PARAMETERS AND STATIC DISTORTIONS IN THE HOMOGENEITY RANGE OF TRANSITION-METAL MONOCARBIDES. Timofeeva, I. I.; Klochkov, L. A. pp 239-245 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The variation in the lattice parameters of carbides of metals of groups IV and V with reduction in their carbon content was analyzed on the basis of experimental results and of data available in the literature. The static lattice distortions in the nonstoichiometric carbides of titanium, zirconium, and hafnium were measured. (auth)

11796 ELECTRON-FRACTOGRAPHIC STUDY OF THE FRACTURES IN ZIRCONIUM CARBIDE AFTER TENSILE TESTING IN THE RANGE 20 TO 2000°C. Turchin, V. N.; Rymashevskii, G. A.; Lanin, A. G. pp 247-249 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A systematic study was made of the fractures in ZrC specimens tested in tension in the range 20 to 2000°C, using optical magnification and the electron microscope. It was found that failure at all temperatures was of the macrobrittle type. It was concluded from the tests that the development of microplastic processes, which adsorb considerable energy during fracture, begins long before the region of the brittle-ductile transition (2000 to 2200°C) is reached. (auth)

11797 PHYSICAL PROPERTIES OF CARBIDES OF RARE-EARTH METALS. Yupko, V. L.; Makarenko, G. N.; Paderno, Yu. B. pp 251-259 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The results are reported of a complex study of the physical properties of a large group of dicarbides and some sesquicarbides of rare-earth metals carried out on the same specimens. Regular features were found in the changes in properties of the carbides at the transition from one phase to another. A diagram of the band structure of the rare-earth metal carbides is proposed. (auth)

11798 REGULARITIES IN THE VARIATION OF THE ELECTROPHYSICAL PROPERTIES OF SOLID-SOLUTION ALLOYS OF SOME CARBIDES OF TRANSITION METALS OF GROUPS IV AND V. Avgustinik, A. I.; Golikova, O. A.; Kudryasheva, L. V.; Ordan'yan, S. S. pp 261-268 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Solid-solution alloys of the systems ZrC–NbC, ZrC–TaC, TiC–NbC, and TiC–TaC were prepared, and their electrical resistivity, thermo-emf, and Hall effect were studied at room temperature. Complete similarity was found in the variation of these electrophysical parameters in stoichiometric solid solutions in the systems $Me^{IV}-Me^{V}C$. The concentration dependence of the above parameters was analyzed. (auth)

11799 THERMAL COEFFICIENT OF THE ELECTRICAL RESISTIVITY OF CARBIDES AND THEIR SOLID SOLUTIONS. Grebenkina, V. G.; Denbnovetskaya, E. N. pp 269-274 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

In order to discover materials with a very low temperature coefficient of the electrical resistivity, a study was made of the temperature dependence of the electrical resistivity of carbides of the transition metals of groups IV to VI, of the carbides TiC, ZrC, and NbC in their homogeneity ranges, and of the complex carbides of the systems ZrC–WC and VC–WC. It is shown that the coefficient diminishes with increase in the proportion of covalent bonding in the Me–Me bond in the compounds investigated. (auth)

11800 STUDY OF SOME PHYSICAL PROPERTIES OF ALLOYS OF THE SYSTEM TaC–WC. Denbnovetskaya, E. N.; L'vov, S. N. pp 275-282 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A study was made of the concentration dependence of the specific electrical resistivity, Hall coefficient, absolute thermo-emf, magnetic susceptibility, microhardness, and crystal lattice constant at room temperature, and also of the temperature dependence of the specific electrical resistivity and the coefficient of the thermo-emf in the range 77 to 300°K, of alloys in the system TaC–WC in the solid-solution region. The regular features observed in the changes in physical properties and the qualitative explanation of them are in accordance with current ideas regarding the electron structure of transition-metal carbides. A suggestion concerning the strengthening of the covalent bond in the Me–Me band of the solid solutions is presented. (auth)

11801 THERMAL EXPANSION OF SOLID SOLUTIONS IN THE SYSTEMS ZrC–NbC AND HfC–TaC. Barantseva, I. G.; Paderno, V. N. pp 283-285 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A study was made of the thermal expansion of pseudobinary carbide alloys in the systems ZrC–NbC and HfC–TaC, which form continuous series of solid solutions. The temperature dependence of the relative elongation is linear or almost so and it displays no unusual features. In both systems there is a reduction in the coefficient of thermal expansion of the alloys as compared with the indi-

vidual carbides. The alloy $Zr_{0.6}Nb_{0.4}C$ in the one system and the alloy $Hf_{0.3}Ta_{0.7}C$ in the other have the lowest coefficients. The decrease in the coefficient of thermal expansion of the alloys is in line with current concepts of the electron structure of the compounds concerned. (auth)

11802 STUDY OF THE GALVANOMAGNETIC AND ELECTRICAL PROPERTIES OF TiC–TiO, TiN–TiO, TiC–TiN, AND ZrC–ZrN ALLOYS. Neshpor, V. S.; Klimashin, G. M.; Nikitin, V. P. pp 287-306 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A study was made of the specific electrical resistivity, thermo-emf, thermal conductivity, and Hall coefficient of the monocarbides of titanium and zirconium and of their alloys with the monoxides and mononitrides. Relationships between the changes in physical properties of the alloys and their composition were established. (auth)

11803 INFLUENCE OF PRODUCTION CONDITIONS ON SOME PHYSICAL PROPERTIES OF TUNGSTEN CARBIDE AND OF A COMPLEX CARBIDE BASED ON IT. Kruchinskii, A. N. pp 307-309 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The microhardness and abrasive power of tungsten carbide and of a complex TiC–WC carbide were determined for various conditions of reduction and carbidization. It was found that both increase with rise in the reduction and carbidization temperatures. The increase in microhardness and abrasive power of high-temperature WC can be attributed to the greater mobility of the tungsten and carbon atoms, which leads to healing of the macro- and micro-defects in the grains during reduction and carbidization, particularly in the case of WC produced at temperatures close to the recrystallization temperatures. (auth)

11804 STUDY OF RECRYSTALLIZATION PROCESSES IN REFRACTORY COMPOUNDS. Kushtalova, I. P. pp 311-313 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

A study of the effect of volume deformation and surface hardening on the properties of the carbides of titanium, niobium, zirconium, molybdenum, and tungsten revealed the presence of slip lines. The temperature at which recrystallization begins was determined from the appearance of the first point discontinuities in the continuous lines of the x-ray diffraction diagrams. The relative temperature at which recrystallization begins in these carbides (T_r/T_{mp}) was found to be 0.5. This is due to distinctive features of the structural changes that occur in refractory compounds on deformation and also to their high bond energy as compared with ductile metals and alloys. (auth)

11805 THERMODYNAMIC PROPERTIES OF TANTALUM CARBIDE IN THE HOMOGENEITY RANGE. Guseva, E. A.; Bolgar, A. S.; Gorbatyuk, V. A.; Fesenko, V. V. pp 317-322 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The heat content of the carbides $TaC_{0.70}$, $TaC_{0.75}$, $TaC_{0.85}$, and $TaC_{0.99}$ was measured in the range 1200 to 2200°K by the method of mixing, using a massive calorimeter. From the results obtained and from data available in the literature, values of the heat content, specific heat, and increase in entropy were tabulated for $TaC_{0.70}$, $TaC_{0.75}$, and $TaC_{0.85}$ for the range 1200 to 2200°K; while for $TaC_{0.99}$ values of the enthalpy, specific heat, entropy, and reduced thermodynamic potential were tabulated for the range 298 to 2500°K. (auth)

11806 STUDY OF THE DEPENDENCE OF SOME THERMODYNAMIC PROPERTIES OF NIOBIUM AND ZIRCONIUM CARBIDES ON TEMPERATURE AND COMPOSITION. Fesenko, V. V.; Turchanin, A. G.; Ordan'yan, S. S. pp 323-328 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Values of the enthalpy of niobium carbides of the compositions $NbC_{0.99}$, $NbC_{0.91}$, $NbC_{0.84}$, $NbC_{0.75}$ and zirconium carbides of the compositions $ZrC_{0.99}$, $ZrC_{0.75}$, $ZrC_{0.69}$ were determined with an accuracy of 1.1% by the mixing method. Equations for the temperature dependence of the enthalpy and specific heat were calculated for the whole temperature range investigated from the experimental results. (auth)

11807 TEMPERATURE DEPENDENCE OF THE CONGRUENTLY EVAPORATED COMPOSITIONS OF THE ZIRCONIUM MONOCARBIDE PHASE AND THEIR EVAPORATION RATE. Nikol'skaya, T. A.; Avarbe, R. G.; Vil'k, Yu. N. pp 329-334 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Zirconium monocarbide was found to be capable of undergoing congruent evaporation. The temperature dependence of the congruently evaporated compositions of the ZrC_x phase can be described by the simple equation $\log (1 - x) = -0.1696 - 1633/T$, and the evaporation rate by the equation $\log V_{congr} = 8.555 - 38134/T$. (auth)

11808 MASS-SPECTROMETRIC STUDY OF THE EVAPORATION OF ZIRCONIUM CARBIDE AT HIGH TEMPERATURES. Torshina, V. V.; Smolina, G. N.; Dobychin, S. L.; Avarbe, R. G.; Vil'k, Yu. N. pp 335-339 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The evaporation of zirconium carbide containing 9.4 to 11.5 wt % C was studied in the temperature range 2000 to 2900°C. ZrC dissociates into its elements. The vapor phase of ZrC comprises Zr and C_1 atoms and C_2 and C_3 molecules. The pressure of the components of the vapor phase is a complex function of composition and temperature. (auth)

11809 THERMODYNAMIC PROPERTIES OF TITANIUM CARBIDE OF VARIABLE COMPOSITION AT HIGH TEMPERATURES. Fesenko, V. V.; Turchanin, A. G. pp 341-346 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Values of the enthalpy of titanium carbide specimens of four different compositions in the homogeneity range were determined experimentally in the temperature range 1300 to 2500°K. Equations were derived for the temperature dependence of the enthalpy, specific heat, and change in entropy of the four carbides. It is concluded that the more rapid increase in enthalpy that occurs in some nonstoichiometric carbides is due to the formation of thermal vacancies. (auth)

11810 INVESTIGATION OF THE HOT HARDNESS OF CAST ZIRCONIUM CARBIDE. Savitskii, E. M.; Kul'bakh, A. A.; Evstyukhin, N. A. pp 361-365 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Measurements of the hot hardness of cast specimens of zirconium carbide with a porosity approaching zero and a density close to the theoretical value are reported. The hardness was determined by a static method in the temperature range 900 to 1650°C. With rise in temperature both cast and hot-compacted zirconium carbide undergo softening. (auth)

11811 MICROHARDNESS OF TRANSITION-METAL CARBIDES. Ivan'ko, A. A. pp 367-370 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The results of investigating the microhardness of carbides of some of the transition metals are reported, and the hardness variations are discussed in relation to the electron structure of the metal atoms. The effect of the conditions of measurement on the microhardness number is noted, and conditions for carrying out the measurements are recommended. (auth)

11812 SOME ASPECTS OF THE ABRASIVE WEAR OF TRANSITION-METAL CARBIDES. Artamonov, A. Ya.; Bovkun, G. A. pp 371-376 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The results of abrasive-wear tests on some carbides are presented. The specimens were tested on a Kh4-B machine, using M. M. Khrushchov's standard procedure. A relationship was established between the relative wear resistance of the carbides and their porosity, hardness, degree of plasticity, and nature of the materials. The wear resistance of the carbides is shown to decrease linearly with rise in porosity. No unique connection was found between the hardness and wear resistance of the carbides; this was due to one specific property of the materials investigated, namely their great brittleness. The results obtained are discussed in terms of the configuration-localization model. (auth)

11813 HARD-FACING ALLOYS BASED ON REFRACTORY COMPOUNDS. Artamonov, A. Ya.; Yurchenko, D. Z.; Kirilets, I. F. pp 377-382 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The results of investigations of hard-facing materials based on some transition-metal borides containing 5 to 15% boron carbide are reported. Iron powder was added to the hard-facing mixtures in order to reduce the brittleness of the boride and carbide phases. A relationship was established between the resistance of the hard-facing layers to abrasive wear and the structure of the layer, the grain shape of the structural constituents, their hardness, and the degree of inhomogeneity, and the quantitative ratio between the hard and soft phases in the hard-facing layer. Hard-facing materials based on the borides of titanium and tungsten displayed a high resistance to wear and can be used to protect the working surfaces of machine components operating under conditions of abrasive wear. (auth)

11814 NEW POLISHING MATERIALS CONSISTING OF QUASI-METALLIC COMPOUNDS. Artamonov, A. Ya; Tutakov, O. V.;

Sychev, V. V. pp 383-389 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The behavior of micropowders of a number of quasimetallic compounds during polishing and finishing operations was investigated. It was found that in these processes micropowders of refractory compounds and the existing abrasive materials are ground in almost the same way and have identical geometry of the grains. The polishing characteristics of the refractory compounds TiC, Cr_3C_2, etc., are no worse than those of existing abrasive materials and are not greatly inferior to synthetic diamond for polishing hardened steel. (auth)

11815 REDUCTION OF THE EROSIVE WEAR OF REFRACTORY COMPOUNDS IN PLASMA STREAMS BY MEANS OF THERMOCHEMICAL PROTECTION. Sleptsov, V. M.; Shchegolev, G. M.; Kukota, Yu. P.; Prshedromirskaya, E. M. pp 399-402 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The efficacy of using thermochemical protection to reduce the corrosive-erosive wear of refractory compounds in high-temperature streams is discussed. A method of producing porous materials is described. An apparatus for determining the resistance of materials in plasma flows was developed. Concentration profiles at the porous wall of a channel when CO_2 is blown into a stream of air are given. (auth)

11816 INDENTORS FOR MEASURING THE HARDNESS OF MATERIALS AT HIGH TEMPERATURES. Dzhemelinskii, V. V.; Koval'chenko, M. S.; Borisenko, V. A.; Makarenko, G. N. pp 403-407 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The possibility of using hot-compacted specimens of boron carbide and titanium diboride as materials for the indentors for measuring the hardness of tungsten carbide at high temperatures was explored. It is shown that a titanium diboride indentor flattens at 1770°K owing to a fall in the hardness of the material at this temperature. A boron carbide indentor can be used repeatedly for measuring the hardness of tungsten carbide at temperatures up to 2170°K without any trace of chemical reaction between the material of the specimen and that of the indentor and also without failure of the latter. (auth)

11817 STUDY OF THE EXTERNAL FRICTION OF REFRACTORY CARBIDES AT HIGH TEMPERATURES IN VACUO. Samsonov, G. V.; Tkachenko, Yu. G. pp 409-414 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The laws governing the external friction of TiC, ZrC, HfC, NbC, and TaC were investigated from room temperature to 1800°C in a vacuum of 10^{-5} mm Hg. The coefficient of friction at first decreases and then increases sharply, beginning at a certain temperature in the range 950 to 1300°C that is characteristic of each carbide. The results obtained are interpreted in terms of both macro- and micro- factors. It is found that the higher the statistical weight of stable configurations (as regards energy) of the atoms of the components of the refractory carbide, the lower is its coefficient of friction. (auth)

11818 CHEMICAL BOND IN CARBIDES OF THE RARE-EARTH METALS. Kosolapova, T. Ya.; Makarenko, G. N.; Domasevich, L. T. pp 417-422 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The results are given of a study of the gaseous products liberated during the decomposition of the carbide phases of the rare-earth metals by water. These products consist mainly of acetylene, ethylene, methane, ethane, and also hydrogen. From an analysis of the composition of the gaseous products in conjunction with an analysis of data on some of their physical properties, it is shown that with increase in the C/Me ratio of the carbides of the rare-earth metals, the nature of the chemical bond changes from being predominantly ionic in MeC phases to being predominantly covalent-metallic in MeC_2 phases. (auth)

11819 STUDY OF THE REACTION OF ZIRCONIUM DIOXIDE WITH THE CARBIDES OF GROUP VI METALS. Fedorus, V. B.; Kosolapova, T. Ya.; Kuz'ma, Yu. B.; Kugai, L. N. pp 423-431 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

The character of the reaction between zirconium dioxide and the carbides of group VI metals Cr_3C_2, Mo_2C, and WC was investigated by means of x-ray, chemical, and metallographic analyses. The nature of the intermediate and end products of the reactions was determined, and the dependence of the phase composition of the reaction products on the sintering temperature was established. A study was made of the resistance of the carbides of molybdenum and tungsten and zirconium dioxide to acids and to mixtures of acids with oxidizing and complex-forming agents. A method is proposed for the chemical phase separation of the compounds concerned. (auth)

11820 STUDY OF THE CORROSION OF NONMETALLIC MATERIALS IN MOLTEN BORAX. Gutman, M. B.; Mikhailov, L. A.; Kaufman, V. G.; Dubovik, T. V.; Kazakov, V. K. pp 441-447 of Refractory Carbides. Samsonov, G. V. (ed.). New York; Plenum Publishing Corp. (1974).

Experiments were carried out in molten borax with and without electrolysis. Corrosion relationships were calculated from the results obtained for the groups of materials tested. Oxide-base materials were found to have a resistance considerably lower than that of materials based on the nitrides of boron and silicon. It was found that in each group materials containing silicon have the least resistance. (auth)

11821 STRUCTURE OF THE DIHYDRIDE PHASE IN THE TITANIUM–VANADIUM–HYDROGEN AND TITANIUM–NIOBIUM–HYDROGEN SYSTEMS. Chertkov, A. A.; Somenkov, V. A.; Shil'shtein, S. Sh.; Kalanov, M.; Mikheeva, V. I. pp 18-21 of Struktura fas, Fazovye Prevrashcheniya i Diagrammy Sostoyanniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120.

The structure of the hydridation and deuteration products with the composition MeH_2 of Ti alloys with 19 at. % V, 34 at. % Nb (zero matrix), and 67 at. % Nb was studied by x-radiographic and neutronographic methods. A fluorite-type structure was established for all the samples studied. The metal atoms form an fcc lattice in whose tetrahedral interstices the H or D atoms are located. The one-phase character of the products studied, the statistical replacement of Ti atoms by atoms of V or Nb, and the almost constant H/Me ratio for different compositions of the original alloy make it possible to study them as solid solutions of the substitution of Ti hydrides with V or Nb hydrides. (tr-auth)

11822 PHASE ANALYSIS OF ALLOYS OF THE TUNGSTEN CORNER OF THE TUNGSTEN–NIOBIUM–CARBON SYSTEM. Savitskii, E. M.; Povarova, K. B.; Makarov, P. V. pp 120-122 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

The W corner of the phase diagram of the W–Nb–C system was studied. For identification of the carbide phases, electrochemical precipitation of the carbides was used. The isothermal cross sections of the W corner of the phase diagram was constructed at 2000 and 1500°C. The polythermal cross section was constructed for constant C contents of 5, 0.5, and 0.05 at. %. (tr-auth)

11823 PHASE DIAGRAM OF THE TERNARY SYSTEM TUNGSTEN–OSMIUM–CARBON IN THE REGION ENRICHED IN TUNGSTEN. Savitskii, E. M.; Povarova, K. B.; Kondakhchan, I. G. pp 123-126 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

By microstructure and x-ray phase analyses and by measuring the hardness of the alloys and the microhardness of the structural constituents, the W corner of ternary W–Os–C system with C contents up to 6 at. % and Os concentrations up to 12 at. % was constructed. Isotherms of the solubility of Os and C in W at 1800 and 1300°C were constructed. On the hardness curves of alloys with C contents up to 1.5 at. % in the interval of 0.5 to 1.5 % Os, the presence of minima analogous to that in the W–Re–C system and connected with electron structure changes was established. (tr-auth)

11824 TUNGSTEN CORNER OF THE TUNGSTEN–ZIRCONIUM–CARBON SYSTEM AT 1700 AND 2000°C. Vedernikova, V. A.; Povarova, K. B.; Popov, A. M.; Postnov, L. M.; Savitskii, E. M. pp 127-129 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

On the basis of light and electron microscopic studies and x-ray phase analysis of the carbides electrolytically precipitated from the alloys, regions of existence of phases at 1700 and 2000°C were established for the W corner of the W–Zr–C system with contents of the alloying elements less than 1 at. %. The studies were made on alloys of slag melts. The boundaries of the two-phase region α + ZrC were established which is necessary for selection of the

optimum composition of alloys hardened by disperse precipitates of ZrC. (tr-auth)

11825 PHASE DIAGRAM OF THE BINARY SYSTEM HAFNIUM–CARBON. Ermenko, V. N.; Velikanova, T. Ya.; Shabanova, S. V. pp 129-132 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

From x-ray phase, metallographic, and microdurometric analyses of the alloys and measuring the temperatures for initiation of fusion using the Piran–Al'tert method, the Hf–C system was studied. It was established that additions of C up to 6 at. % decrease the fusion temperature to 2180 ± 20°C, during which a eutectic nonvariant equilibrium was observed between phases based on the α and β modifications of Hf. C stabilizes the α modification of Hf up to equilibrium with the liquid phase at 2240 ± 20°C. A peritectic nonvariant equilibrium was observed during this stabilization. Extension of the region of homogeneity of the α phases along the solidus line was observed from 3 (at 2180°) up to 14 (2240°) at. % C and a decrease with decrease of the temperature. Hafnium carbide is formed with the carbon of the eutectic at 3180°C for alloys containing no Zr. (tr-auth)

11826 CRYSTALLIZATION PROCESSES OF YTTRIUM OXIDE IN THE 600 TO 1600°C RANGE. Degen, M. G.; Bondar, I. A. (Inst. of Silicate Chemistry, Leningrad). Dokl. Chem. Technol. (Engl. Transl.); 214-216: 54-57(1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 4, 924-927(Apr 1974).

The study was conducted using electron microscopy, light microscopy, and x-ray phase analysis. Y_2O_3 granules are round when calcined at 600 to 800°C, edges appear at 1000°C, and the granules assume a hexagonal shape at 1200 to 1600°C. Rapid crystal growth occurs at 800 to 1000°C and again at > 1200°C. The equation for the crystal growth rate is $V = 368 \times 10^5\, l^{-0.008\,T}$, where l is the crystal size. The relation between l and time is linear. The crystal-morphological nature of Y_2O_3 changes sharply at 1000-1200°C. (DLC)

11827 CRITICAL MAGNETIC FIELDS OF SUPERCONDUCTING PALLADIUM HYDRIDE. Alakseevskii, N. E.; Samarskii, Yu. A.; Wolf, H.; Tsebro, V. I.; Zakosarenko, V. M. (Inst. of Physics Problems, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 11, 350-351(5 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 11, 676-679(5 Jun 1974).

Critical magnetic fields of palladium hydrides with different values of T_c and calculated the coefficient of electronic specific heat γ. It turned out that $\gamma = 0.28 \pm 0.02$ mcal/mole $(°K)^2$ regardless of the hydrogen concentration. It appears that the growth of T_c with increasing H concentration is due to the increase of the electron-phonon interaction constant. (auth)

11828 ESR OF V^{4+} IN AMORPHOUS AND CRYSTALLINE V_2O_3. Kahn, A.; Livage, J.; Collongues, R. (CNRS, Paris). Phys. Status Solidi (a); 26: No. 1, 175-179(16 Nov 1974).

The ESR study of V^{4+} in amorphous V_2O_3 shows that this ion is in a site having a strong axial anisotropy. The parameters of the spin Hamiltonian describing the spectra are $g_{||} = 1.926$, $A = 190 \times 10^{-4}$ cm^{-1}, $g_{\perp} = 1.984$, and $B = 73 \times 10^{-4}$ cm^{-1}. Comparison with the ESR spectra of V^{4+} in V_2O_3 single crystals shows that short-range order in the amorphous oxide is slightly different from that in the crystal. It appears that the average distance between the 3d unpaired electron and ^{51}V nucleus is shorter in the amorphous state. This fact should be related to the higher electrical resistivity found in the glass. (auth)

11829 CORRESPONDENCE OF LATTICE CHARACTERISTIC TEMPERATURES WITH DEBYE TEMPERATURES OF SOME INORGANIC COMPOUNDS. Reeber, R. R. (Cambridge Univ., Eng.). Phys. Status Solidi (a); 26: No. 1, 253-260(16 Nov 1974).

Characteristic temperatures of solids are useful parameters that relate physical and thermal properties of solids to a specific model. The correspondence of an empirical average of one-dimensional lattice temperatures with the well-known Debye temperatures is illustrated. In addition, correspondence of states behaviour for zinc blende and cesium chloride structures is extended to include alkali-halides and other rock-salt compounds. Some implications for considerations of anisotropy in geophysics and melting are also discussed. Compounds covered include TaC, ZrC, and UC. (4 tables, 29 references) (DLC)

11830 X-RAY INDUCED DECREASE OF PERMEABILITY IN YIG SINGLE CRYSTALS WITH Pb IMPURITY. Hisatake, K. (Aoyama Gakuin Univ., Tokyo); Ohta, K.; Ichinose, N.; Yokoyama, H. Phys. Status Solidi (a); 26: No. 1, K79-K82(16 Nov 1974).

X-ray irradiation was performed by a Mo anode tube at 23 mA and 50 kV. The decay curve of permeability under irradiation was recorded; the sample was cooled to 77°K in the dark before irradiation. The permeability decreases from $\mu = 70$ to 6 in 3 min under irradiation. The decay is broad compared to that after visible light irradiation, with $\tau_1 = 0.6$ min and $\tau_2 = 173$ min. The number of x-ray quanta is estimated. (DLC)

11831 ANALYSIS OF SPECTRAL LINE INTENSITIES OF TR^{3+} IONS IN DISORDERED CRYSTAL SYSTEMS. Kaminskii, A. A.; Li, L. (Inst. of Crystallography, Moscow). Phys. Status Solidi (a); 26: No. 1, K21-K26(16 Nov 1974).

An experimental and theoretical investigation was made of the intensities of lines in the absorption and luminescence of the following compounds doped with Nd^{3+}ions: $Y_3Al_5O_{12}$, $Lu_3Sc_2Al_3O_{12}$, BaF_2-CeF_3, BaF_2-LuF_3, and $ZrO_2-Y_2O_3$. Intensity parameters, inter-manifold luminescence branching ratios from the metastable $^4F_{\frac{3}{2}}$ state and its luminescent lifetime are tabulated. (DLC)

11832 METHOD FOR PRODUCING FUELED MODERATOR. Cahoon, J. B. Jr. (to United States Atomic Energy Commission). US Patent 3,849,329. 19 Nov 1974. Filed date 1 Oct 1959. 6p.

A method is given for producing a high-density fueled beryllia, compact thermally stable at temperatures above 1,500°C. The method comprises the steps of dissolving about 4 wt % uranium chloride in ethyl alcohol, slurring an intermediate-grade-purity beryllia having a mean particle size of less than 10 microns in said ethyl alcohol solution, evaporating said solution at room temperature by vacuum, whereby free flowing powders are produced, compacting a quantity of said powders isostatically at a pressure greater than 20,000 psi, heating said compact in a furnace through which air is freely circulating for a period of at least 10 hours and to a maximum temperature of at least 1,000°F, and thereafter sintering said compact for at least 1 hour in hydrogen at a temperature at least as high as 1,500°C. (Official Gazette)

11833 KINETIC STUDY OF THE NITROGENATION OF PLUTONIUM HYDRIDE WITH NITROGEN. Muromura, T.; Ouchi, K. (Japan Atomic Energy Research Inst., Ibaraki). J. Inorg. Nucl. Chem.; 36: No. 11, 2525-2530(Nov 1974).

The nitridation of plutonium hydride powder (200 to 325 mesh) with nitrogen was studied in the temperature range of 200 to 300°C. It was found that the reaction obeyed the so-called linear law during an early period and that the rate was not affected by gas flow velocity. It was also found that the rate increased with decreasing partial pressure of nitrogen and was independent of the partial pressure of hydrogen. The activation energy was about 36 kcal/mol for PuH_3 and 47 kcal/mol for PuH_2. X-ray diffraction study showed the product to be PuN, of which lattice parameter was 4.902 ± 0.002 Å. From these results, it is considered that the nitridation is controlled by the reaction at the hydride–nitride interface. On the basis of the Langmuir isotherm, the dependence of the reaction rate on the partial pressure of nitrogen is discussed. (auth)

11834 SLAG RESISTANCE OF HIGH-DENSITY CERAMICS FROM PURE OXIDE. Belyakov, A. V.; Poluboyarinov, D. N.; Mal'kov, M. A. (Inst. of Chemical Tech., Moscow). Refractories (USSR) (Engl. Trans.); 15: No. 1-2, 103-106(1974).

Translated from Ogneupory; 15: No. 2, 31-36(Feb 1974).

The crucible method was employed to determine the saturation concentration and pattern of interaction with typical basic open-hearth slag of materials prepared from MgO, Al_2O_3, $MgO \cdot Al_2O_3$, stabilized ZrO_2, $3Al_2O_3 \cdot 2SiO_2$, $SrO \cdot ZrO_2$, and Y_2O_3. Two versions of the method were used: depositing the slag in a heated crucible fabricated from the material, and heating the slag together with the crucible. In parallel experiments, the saturation concentration (grams material dissolved in one gram of the original slag) was determined by the method of revolving the specimen in a platinum crucible together with the slag. This is a more precise method than the crucible method. For Al_2O_3 and $3Al_2O_3 \cdot SiO_2$, which resist impregnation, the two crucible methods gave identical results while in the case of $MgO \cdot Al_2O_3$ and Y_2O_3 the degree of impregnation increased when the slag was heated together with the crucible. The difference can be attributed to the nonisothermic nature of the process of the interaction of the slag with the ceramic since the ceramic reacts first with the eutectics of the slag which melt at temperatures below 1550°C. The saturation concentration determined by the crucible method agrees with the revolving method for MgO, Al_2O_3, and $3Al_2O_3 \cdot SiO_2$ which are not prone to impregnation. For ceramic processed from $MgO \cdot Al_2O_3$, stabilized ZrO_2, Y_2O_3, and $SrO \cdot ZrO_2$, all of which are prone to impregnation, the determination of the volume of crucible erosion by the crucible method gave greatly overstated results which did not match with the saturation concentration. (auth)

11835 FIBRES. Morton, M. J.; Birchall, J. D.; Cassidy, J. E. (to Imperial Chemical Industries Ltd.). British Patent 1,360,199. 17 Jul 1974. 11p.

Polyethylene oxide is employed as a constituent material of a fiber process. Preferably there is at least twice as much metal compound as there is polymer in the material. Fiberizing is carried out by a "blowing" process, details of which are described. The fiberizing material is extruded through one or more apertures into gas streams having a high velocity component in the direction of travel of the extruded material. The gas streams are preferably air, at ambient temperature, and it is convenient to employ two streams converging at or near the point where the material is extruded from the aperture. The fibers produced are usually of small diameter, typically 0.5 to 5μ, and are generally in discontinuous lengths, which may, however, have very high length/diameter ratios, for example >5000. The fibers may be collected individually or in the form of yarn, mat or felt. If desired the fibers may be bonded together by collecting them before they are dry and heating the resultant mat or felt, or a binding agent may be used. Details are given for preparation of the fiberizing material. Examples are given of the application of the process to the production of fibers comprising mixed phases of Mg spinel, Al borate and Al_2O_3, and also ZrO_2 and Al_2O_3 fibers. (UK)

11836 FIBRES. Morton, M. J.; Birchall, J. D.; Cassidy, J. E. (to Imperial Chemical Industries Ltd.). British Patent 1,360,200. 17 Jul 1974. 11p.

Polyvinyl alcohol or partially hydrolyzed polyvinyl acetate is employed as the polymeric constituent of the fiberizing material. The proportion by weight of the metal compound is greater than that of the polymer. Fiberizing is carried out by a "dry spinning" process: this comprises fiberizing into a gaseous atmosphere (usually air), as distinct from fiberizing into a precipitating liquid ("wet spinning"). Fiberizing by "dry spinning" may be carried out centrifugally, by drawing or blowing, or by extrusion through a spinneret, the latter process being useful for producing a continuous fiber. Details are given for preparation of the materials. The fiber may be in the form of continuous or discontinuous lengths or in the form of a mat or felt. The fibers produced are usually of diameter from 0.5 to 50μ. Examples are given of application of the process to the production of Al_2O_3 and ZrO_2 fibers. (UK)

11837 IMPROVEMENTS IN OR RELATING TO THE REMOVAL OF SILICA FROM MATERIALS CONTAINING SILICA. White, J.; Richmond, S. (to GR-Stein Refractories Ltd.). British Patent 1,361,607. 31 Jul 1974. 3p.

A process is described for the production of ZrO_2 from zircon, capable of removing the SiO_2 content of the zircon. The zircon in particulate or pelletized form is heated under reducing conditions in an atmosphere containing S, the reaction removing the SiO_2 in the form of a volatile Si sulfide. In order to produce the required reducing conditions the zircon may be mixed with C so that CO is formed along with the volatile sulfide, the quantities of materials employed being controlled so as to ensure that no residual C remains after the reaction is completed. If an excess of C is employed, however, any residual C can be employed to give the reducing conditions steam being also produced. The S may be introduced as a powder or as vapor entrained in a carrier gas. If H_2 is used the S can be introduced in a stream of this gas containing N_2. When C is used H_2 may also be used as carrier gas, or N_2 or Ar may be used. H_2S may also be used to serve the double purpose of creating reducing conditions and providing the S. The sulfide may also be introduced in a stream of CH_4. By way of example the process is described using H_2 and C to create the reducing conditions and employing gaseous S. The reaction is preferably conducted at above 1000°C, the optimum temperature range being 1200°C to 1400°C. It is important that the atmosphere above the reaction mixture is continuously removed to prevent reversal of the process. (UK)

11838 NEODYMIUM NIOBATES AND THEIR ELECTROPHYSICAL PROPERTIES. Sych, A. M.; Eremenko, L. A.; Zastavker, L. A.; Nekrasov, M. M. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 3, 423-426(Mar 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 3, 496-500(Mar 1974).

During precipitation of Nb and Nd as hydroxides from alcohol solutions, the components react to form intermediate products of possible composition $Nd_3[Nb(OH)_6]$. When a charge of coprecipitated Nd and Nb is heated, a reaction takes place without formation of Nb_2O_5 and Nd_2O_3; depending on the ratio of the components, it leads to formation of neodymium metaniobate or orthoniobate. The crystal structure of $NdNbO_4$ is of the fergusonite type, that of Nd_3NbO_7 is of the perovskite type. The resistivity, dielectric constant, and dielectric losses of Nd_3NbO_7 and $NdNbO_4$ were measured in the range 20–300°C. At room temperature, the conductivity of neodymium meta- and orthoniobate is 10^{-9}–10^{-10} $\Omega^{-1} \cdot cm^{-1}$, and the dielectric constant is 50–100, depending on the frequency. (auth)

11839 ELECTRON-MICROSCOPE INVESTIGATION OF NONSTOICHIOMETRIC ZIRCONIUM HYDRIDE. Kostikova, K. P. Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 3, 482-484(Mar 1974).

Translated from Izv. Akad. Nauk SSR, Neorg. Mater.; 10: No. 3, 561-563(Mar 1974).

The ϵ-phase $ZrH_{1.92}$, with a banded structure, was investigated using transmission electron microscopy of foils. Results revealed the banded structure (partly fissured), defects of complicated shape and extinction contours (probably intersecting microtwins), and dislocation walls of small-angle grain boundaries. The density of the dislocations at the small-angle faces is calculated to be about 10^{10} cm^{-2}. (DLC)

11840 RELATIVISTIC SYMMETRIES AND LOWER BOUNDS FOR THE MAGNETO-ELECTRIC SUSCEPTIBILITY AND THE RATIO OF POLARIZATION TO MAGNETIZATION IN A FERROMAGNETOELECTRIC CRYSTAL. Ascher, E. (Battelle Memorial Inst., Geneva). Phys. Status Solidi (b); 65: No. 2, 677-688 (1 Oct 1974).

A definition of the relativistic symmetry of a polarized crystalline medium is proposed. The requirement of invariance of the susceptibility under this group gives rise to relations between the components of the tensor which then are used in the case of orthorhombic boracite to obtain lower bounds for the magneto-electric susceptibility and for the ratio of the spontaneous polarization to magnetization. (auth)

11841 MAGNETIC PROPERTIES AND INDIRECT EXCHANGE IN $Gd(Ni,Cu)_2$. Poldy, C. A.; Kirchmayr, H. R. (Technische Hochschule, Vienna). Phys. Status Solidi (b); 65: No. 2, 553-560 (1 Oct 1974).

The magnetic properties of compounds in the $Gd(Ni,Cu)_2$ pseudobinary system are described and the variation of the ordering temperatures with composition is accounted for in terms of the Rudermann–Kittel–Kasuya–Yosida theory. In excellent agreement with experiment the model is used to predict a transition from the antiferromagnetic state of $GdCu_2$ to the ferromagnetic one upon replacing 13% of Cu by Ni, where it is assumed that the 3d-states of Ni are filled. Support for this assumption is obtained by considering the Curie temperature variation of the Ni-rich end of this system in conjunction with the $Gd(Co,Ni)_2$ system. (auth)

11842 ESTIMATE OF THE d–d OVERLAP OF V_2O_5 FROM ESR MEASUREMENTS. Sperlich, G.; Laze, W. D. (Technische Hochschule, Darmstadt, Ger.). Phys. Status Solidi (b); 65: No. 2, 625-631(1 Oct 1974).

ESR spectra are given of d electrons which are localized in the randomly arranged Coulomb fields of Li^+ and Cu^+ ions in single crystals of $Li_xV_2O_5$ and $Cu_xV_2O_5$ ($x \lesssim 0.01$). A localization within four vanadium 3d orbitals is derived from the hyperfine spectra. A resolved hyperfine splitting disappears at temperatures below about 15°K. The corresponding variation of the nonperiodic Coulomb field allows a rough estimate of the d-overlap integral. (auth)

11843 BANDING IN NIOBIUM–NIOBIUM CARBIDE (Nb_2C) COMPOSITES GROWN BY ZONE MELTING AND FREEZING. David, S. A.; Brody, H. D. (Univ. of Pittsburgh). Met. Trans.; 5: No. 12, 2608-2611(Dec 1974).

The role of composition inhomogeneities on the banding of Nb–Nb_2C composites is considered. Three types of bands were observed: (1) discontinuity of carbide phase and continuous band of Nb, (2) thickening of carbide phase, and (3) discontinuity of Nb phase and continuous band of carbide. The mathematics of the composition changes is discussed. The experiments indicated that inhomogeneities in the feed rod were the main factor leading to banding; two zone levelling passes before composite growth were sufficient to control banding. (DLC)

11844 VIBRATION SPECTRA OF DIFFERENT STRUCTURAL MODIFICATIONS OF BORON NITRIDE. Gatilova, S. G.; Malogolovets, V. G.; Bochko, A. V.; Dzhamarov, S. S.; Yarosh, V. V. (Inst. of Problems in Materials Science, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 10, 941-945(Oct 1974). (In Ukrainian).

Vibration spectra were studied for three modifications of boron nitride: graphite-like, wurtzite-like, sphalerite-like. The ir spectrum of wurtzite-like boron nitride obtained by means of shock waves is rather close to that of the cubic modification. Splitting of the resonance absorption band of 1120 cm^{-1} characteristic of the boron nitrite cubic modification into 1100 cm^{-1} and 1130 cm^{-1} reflects the difference in the bond strength of these

two modifications and the presence of small anisotropy of the properties in case of wurtzite-like boron nitride, which is in good agreement with x-ray spectra. (auth)

11845 PARA-TO-ORTHO H_2 CONVERSION ON Gd, Y, Gd_2O_3, AND Y_2O_3. Rossington, D. R.; Capozzi, V. F. (Alfred Univ., NY). J. Amer. Ceram. Soc.; 57: No. 11, 474-477(Nov 1974).

The mechanism of parahydrogen conversion was studied on Gd_2O_3 and Y_2O_3 powders and on Gd and Y evaporated metal films at low and high temperatures (77 to 90°K and 298 to 418°K). Absolute rates of conversion are compared to theoretical values for 3 possible reaction mechanisms, and it is concluded that a paramagnetic vibrational mechanism is operative on Gd_2O_3, Gd, and Y. On Y_2O_3, the reaction rate is enhanced by additional surface paramagnetic sites. The portion of the surface which is active is ≈1 for the metals and ≈0.01 for the oxides. (5 fig, 4 tables) (auth)

11846 TSIRKONIEVYE GLAZURI. (Zirconium Enamels). Nosova, Z. A. Moscow; Stroiizdat (1973). 192p.

Opaque Zr enamels are described. The composition of white and colored enamels and their basic physical chemical properties are reported. The damping mechanism of Zr enamels is examined. The technology for their preparation and the methods for their deposition are described. The annealing characteristics and the methods for the quality control of the enamels are discussed. Their use in the production of construction ceramics is considered. (tr-auth)

11847 PHASE DIAGRAM OF MoO_3–NiO SYSTEM. Yanushkevich, T. M.; Zhukovskii, V. M.; Ust'yantsev, V. M. (Ural State Univ., Sverdlovsk, USSR). Zh. Neorg. Khim.; 19: No. 7, 1932-1936(Jul 1974). (In Russian).

A phase diagram was constructed for the MoO_3–NiO system based on data obtained from differential thermal analysis, visual polythermia, high-temperature x-ray analysis, and electrical-resistance measurements in the solid phases. The unique chemical compound $NiMoO_4$ existed in two modifications. The reverse $\alpha \rightleftharpoons \beta$ transition occurred at 610 ± 10°C. β-$NiMoO_4$ melted incongruently at 1310 ± 10°C. The eutectic temperature in the composition range from MoO_3 to $NiMoO_4$ was 770 ± 5°C. (tr-auth)

11848 STRUCTURE AND STAGES OF IDENTITY OF SOLID SOLUTIONS OF SAMARIUM AND TERBIUM ORTHOFERRITES. Sirota, N. N.; Lomako, I. D. (Inst. of Physics of Solid State and Semiconductors, Minsk). Dokl. Akad. Nauk BSSR; 18: No. 9, 788-790(Sep 1974). (In Russian).

Monocrystals of the quasi-binary system $Sm_xTb_{1-x}FeO_3$ orthoferrites (x = 0, 0.2, 0.4, 0.55, 0.8, 1) were precipitated from solution in the melt. The crystal lattice of the orthoferrites was a distorted structure of perovskite and is described by the rhombic group D_{2h}^{16}. Values are given for inter-planar distances and indexes and intensities of the lines on roentgenograms in relative units. With increase in the terbium ion content in the solid solutions studied, the lattice parameters a and c decreased linearly, but b remained practically unchanged, with the volume of the elementary cell decreasing somewhat. (tr-auth)

11849 OXYGEN-FUGACITY–TEMPERATURE DIAGRAM FOR THE Eu–O SYSTEM. McCarthy, G. J. (Pennsylvania State Univ., University Park). J. Amer. Ceram. Soc.; 57: No. 11, 502 (Nov 1974).

Recent thermodynamic data from Gschneider et al. (IS-RIC-6) are used to update the author's diagram (McCarthy and White, J. Less-Common Metals; 22: 409-417(1970)). Curves are given for the oxidation reactions of Eu to EuO, EuO to Eu_3O_4, and Eu_3O_4 to Eu_2O_3. Errors and uncertainties are discussed. (DLC)

11850 FACTORS AFFECTING BORAZON (CUBIC BORON NITRIDE) GRINDING SYSTEMS. Lindsay, R. P. Technical Paper No. MR73-122. Dearborn, MI; Society of Manufacturing Engineers (1973). 28p.

Laboratory data are presented on the effect of wheel speed and axial reciprocation upon the grinding characteristics of Borazon CBN wheels. Using these findings, production internal grinding of small-bore parts was performed on 52100 and 1015 steels and the pertinent results are detailed. The ability of various Borazon CBN wheels to continually produce commercial-quality work pieces under high production conditions is discussed. (Metals Abstr.)

11851 ELECTRON-BEAM-INDUCED CONDUCTIVITY ON THIN SPUTTERED FILMS OF Al_2O_3. Adams, P. M.; Jones, P. L.; Taylor, E. F.; Litting, C. N. W. (Univ. of Manchester, Eng.). J. Phys., D (London); 7: No. 15, L165-L166(11 Oct 1974).

The electron-beam-induced conductivity of thin sputtered films of Al_2O_3 was investigated. Measurements were made of the variation of the coefficient of induced conductivity γ with primary beam voltage, primary beam current and bias voltage. The maximum value of γ observed in the films was 5, being mainly limited by the low (8×10^7 V m^{-1}) breakdown strength of the films. (auth)

11852 FIBRES. Morton, M. J.; Birchall, J. D.; Cassidy, J. E. (to Imperial Chemical Industries Ltd.). British Patent 1,360,197. 17 Jul 1974. 16p.

A process is described for the preparation of fibers suitable for general purposes, including textiles, catalytic purposes, and reinforcement. It comprises the steps of first dry-spinning material having a viscosity of at least 1 poise, this material comprising a solvent in which is dissolved a metal compound and an organic polymer, the amount of polymer being less than 10% by weight of the metal compound. By dry-spinning is meant fiberizing into a gaseous atmosphere (preferably air). The second step involves removal of at least part of the solvent from the fiber by evaporation. The metal compound is preferably water soluble to give a viscous solution or sol, and is perferably a salt that forms a sinterable refractory oxide on heating. A list of suitable salts is given. The solvent is preferably a polar solvent, such as an alcohol, glacial acetic acid, dimethylsulphoxide or dimethylformamide, or water may be used as solvent. The polymer is preferably a water soluble organic polymer, and conveniently a non-ionic water soluble organic polymer, a polyhydroxylated organic polymer, or a natural water soluble gum; a list of preferred organic polymers is also given. The most preferred polymers are straight chain polyhydroxylated organic polymers, such as polyvinyl glycol. Details are given of the spinning process. Binding agents may be used. The fiberizing material may contain a grain growth inhibitor and also a stabilizer such as formic acid, acetic acid or tartaric acid; suitable additions where the fiber comprises ZrO_2 are listed. The resulting fibers may be size coated. Catalytic material may be deposited on the fibers. Examples of application of the process are described. (UK)

11853 DEPENDENCE OF RATE OF SPUTTERING BY FISSION FRAGMENTS ON SPUTTERED-LAYER THICKNESS. Aleksandrov, B. M.; Babadzhanyants, N. V.; Baranov, I. A.; Krivokhatskii, A. S.; Krizhanskii, L. M.; Tutin, G. A. Sov. J. At. Energy (Engl. Transl.); 36: No. 2, 171-173(Feb 1974).

Translated from At. Energ. (USSR); 36: No. 2, 139-140(Feb 1974).

Layers of ^{241}Am and ^{238}Pu in the form of hydroxide were deposited on Ti substrates. Data on self-sputtering of thin ^{241}Am and ^{238}Pu layers show that the fundamental role in sputtering is played by ^{237}Np and ^{234}U recoil nuclei formed as a result of α decay at depths no greater than a few $\mu g/cm^2$ from the surface. (JRD)

11854 PREPARATION OF GLASS-CRYSTAL FERROELECTRICS IN THE $Pb_{0.5}R_{0.5}Nb_2O_4$–SiO_2 SYSTEM. Stetsyuk, O. A.; Pavlushkin, N. M.; Agarkov, A. S.; Zhabotinskii, V. A. Tr. Mosk. Khim.-Tekhnol. Inst.; No. 72, 39-41(1973). (In Russian).

The effects of substitution of half the lead cations in $PbNb_2O_6$ on the dielectric and ferroelectric properties of glass ceramics were studied in the system $Pb_{0.5}$–$R_{0.5}Nb_2O_6$–SiO_2 where R = Mg, Ca, Sr, Ba, Zn, or Cd. Infrared transmission spectra showed a difference in the effect of cation modification on the process of glass formation and crystallization in the system. The optimum crystallization regime, selected by differential thermal analysis, x-ray analysis, and light microscopy, was when R = Sr, Ba, or Ba + Sr. These glass-crystalline ferroelectric materials had high dielectric penetrabilities and Curie temperatures and could be used for making small condensers to operate at high temperatures. (INIS)

11855 THERMOPHYSICAL PROPERTIES OF TRANSITION METAL CARBIDES AND DIBORIDES. Samsonov, G. V.; Bolgar, A. S.; Guseva, E. A.; Klochkov, L. A.; Kovenskaya, B. A.; Serebryakova, T. I.; Timofeeva, I. I.; Turchanin, A. G.; Fesenko, V. V. (AN Ukrainskoj SSR, Kiev. Inst. Problem Materialovedeniya). High Temp. - High Pressures; 5: No. 1, 29-33(1973).

From 3rd European conference on thermophysical properties; Turin, Italy (20 Jun 1972).

A systematic study is reported of the enthalpy and specific heat of transition metal carbides; the difference in the composition dependences of the specific heats of carbides of Group IV and Group V transition metals is established. The results are correlated with the measurements of the thermal expansion of these carbides in the range 300 to 1200°K. The thermal expansion and thermal conductivity of diborides of Group IV to VI transition metals were studied in the range 300 to 2500°K. It was found that the thermal expansion increases, and the thermal conductivity decreases, in the order Group IV–V–VI transition metal diborides. It is shown that the thermophysical properties are mainly influ-

enced by the statistical weight of boron and carbon atoms with sp configurations and also by the degree of stabilization of these configurations. In the case of pronounced delocalization of electrons participating in the sp configuration the factors that become important are the localization of electrons in the d^5 configuration and the density of excess unlocalized electrons in carbide and boride lattices. (auth)

11856 EXPERIMENTAL STUDY OF THE THERMODYNAMIC PROPERTIES OF REFRACTORIES AT HIGH TEMPERATURES. Bondarenko, V. P.; Fomichev, E. N.; Kandyba, V. V. (Khar'kovskij Gosudarstvennyj Nauchno-Issledovatel'skij Inst. Metrologii (Ukrainian SSR)). High Temp. - High Pressures; 5: No. 1, 5-7 (1973).

From 3rd European conference on thermophysical properties; Turin, Italy (20 Jun 1972).

The results of experimental enthalpy determinations for a range of elements, oxides, carbides, and silicides at high temperatures are tabulated in the form of coefficients of a fitted polynomial $\Delta H^T_{298.15} = aT + bT^2 + cT^{-1} + d$. The results for transition metal disilicides are interpreted in terms of the acceptor characteristics of transition metal atoms. (auth)

11857 PLASTICITY OF POLYCRYSTALLINE URANIUM DIOXIDE AT HIGH TEMPERATURES. Ferro, C.; Ruggeri, F. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). High Temp. - High Pressures; 5: No. 1, 39-46(1973).

From 3rd European conference on thermophysical properties; Turin, Italy (20 Jun 1972).

Sintered uranium dioxide specimens were subjected to compression tests at temperatures of 1670 to 2400°K. At low stresses the creep rate is given by a relationship of the form $\epsilon = A\sigma^n \exp(-\Delta H/RT)$. The results obtained for viscosity are in agreement with the values obtained by other workers. (auth)

11858 OXYGEN ION CONDUCTION OF THE FLUORITE-TYPE $Ce_{1-x}Ln_xO_{2-x/2}$ (Ln = LANTHANOID ELEMENT). Kudo, T.; Obayashi, H. (Central Research Lab., Tokyo). J. Electrochem. Soc.; 122: No. 1, 142-147(Jan 1975).

The compounds $Ce_{1-x}Ln_xO_{2-x/2}$ (Ln = lanthanoid element) were synthesized and the emf and resistivity measurements were carried out between 400 and 1000°C. Charge carriers of conduction in these compounds are oxygen ions above 600°C. The oxygen transference number is above 0.95 for all measured compounds. The resistivity value for $Ce_{0.77}Gd_{0.23}O_{1.885}$ is 15 ohm-cm at 750°C, which compares with that of calciastabilized zirconia at 1000°C. The dependence of the resistivity on temperature is described by $\rho = (\rho_0)_L \exp(\Delta E_L/kT) + (\rho_0)_H \exp(\Delta E_H/kT)$ for most of the compounds, where the (ρ_0)'s and ΔE's are empirically determined parameters. The activation energies of conduction are determined by the compounds' lattice constant so long as the dopant concentration is held constant. The activation energies increase as the dopant concentration x increases and ΔE_L and ΔE_H coincide at $x \geq 0.4$. (auth)

11859 LOW TEMPERATURE X-RAY DIFFRACTION STUDIES ON U_3O_8. Momin, A. C.; Jakkal, V. S.; Karkhanavala, M. D. (Bhabha Atomic Research Center, Bombay). Indian J. Chem.; 12: No. 7, 752-753(Jul 1974).

The cell parameters of the stoichiometric orthorhombic α-U_3O_8 were determined in the range 35 to 473°K. Coefficients of average linear and the volume expansion of orthorhombic U_3O_8 were determined from the cell parameter measurements. The overall expansion coefficient along a-axis is positive whereas the overall expansion coefficient along b and c axis is negative. The overall negative volume expansion coefficient as determined from the cell parameters shows a broad minimum around 250°K. (auth)

11860 DEPOSITED TITANIUM CARBIDE ON REFRACTORY SUBSTRATES. Elyutin, V. P.; Pavlov, Yu. A.; Nikitin, K. A.; Manukhin, A. V.; Pegov, V. S.; Petrikin, Yu. N.; Blinkov, I. V. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 1, 5-7(1974). (In Russian).

For English translation see the journal Stal USSR.

The process of deposition of titanium carbide on refractory substrates (W and Mo) from the gaseous phase in pulsed plasma in an atmosphere of hydrogen and carbon-containing gases was studied. The dependence of the thickness of the deposited coating on the number of plasma pulses was obtained. The effect of the composition of the gaseous phase (concentration of CH_4 and H_2) on the deposition process was studied. The microhardness of the coatings was measured and the lattice parameters of the titanium carbide deposited were calculated. (tr-auth)

11861 ELECTRONIC MAGNETIC ORDERING INDUCED BY HYPERFINE INTERACTIONS IN TERBIUM AND HOLMIUM GALLIUM GARNETS. Hammann, J.; Manneville, P. (CEN de Saclay, Gif-sur-Yvette, France). pp 328-333 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York, Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Magnetization, anisotropy, and specific heat measurements down to 0.36°K did not show any transition. Hyperfine interactions are considered, and it is seen that TbGaG and HoGaG undergo a magnetic transition to an antiferromagnetic structure of the AFA type as in TbAlG and HoAlG. (DLC)

11862 LOW-FIELD MAGNETIC PROPERTIES OF $DyVO_4$ AND $TbPO_4$. Suzuki, H. (Tohoku Univ., Sendai); Ohtsuka, T.; Yamadaya, T. pp 334-337 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

$DyVO_4$ shows a cooperative Jahn-Teller distortion from the tetragonal zircon structure to orthorhombic symmetry at $T_D \cong 14$°K accompanied by a change in magnetic properties. A SQUID (superconducting quantum interference detector) was used to measure the dc susceptibility in very low fields near T_D. In contrast to $DyVO_4$, which shows an anomaly at 14°K and an antiferromagnetic transition at $T_N \cong 3$°K, $TbPO_4$ has no crystal lattice transition down to $T_N \cong 2.2$°K. An anomalous peak directly below T_N was observed for $TbPO_4$. (DLC)

11863 MAGNETISM AND METAL-NONMETAL TRANSITION IN NARROW ENERGY BANDS: APPLICATIONS TO DOPED V_2O_3. Cyrot, M.; Lacour-Gayet, P. (Paris Univ., Orsay, France). pp 551-554 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The simplified Hubbard model (ratio of Coulomb repulsion between electrons to bandwidth) for correlations between electrons, independent of degeneracy or real band structure, is used to construct a phase diagram for Cr-doped V_2O_3. Stability of the phases is discussed. It is shown that the Hubbard model explains the absence of a metallic antiferromagnetic phase, the existence of a first-order transition, and the existence of a critical temperature above which no phase transition occurs. (DLC)

11864 THERMODYNAMIC PROPERTIES AND MONOCLINIC-TETRAGONAL TRANSITION OF NONSTOICHIOMETRIC ZIRCONIUM DIOXIDE. Vasil'eva, I. A.; Granovskaya, Zh. V. (Moscow State Univ.). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 436-437(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 755-756(Mar 1974).

The partial thermodynamic functions of the oxides ZrO_{2-x} (χ = 0.002, 0.001) have been determined by an e.m.f. method with a solid electrolyte at 1173-1373°K. The effect of departure from the stoichiometric composition on the temperature of the monoclinic-tetragonal phase transition of zirconium dioxide is considered. (auth)

11865 X-RAY PHOTOELECTRON STUDIES OF THORIUM, URANIUM, AND THEIR DIOXIDES. Veal, B.W.; Lam, D.J. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 10: No. 12, 4902-4908 (15 Dec 1974).

The valence-band structures of the light actinides thorium, uranium, and their dioxides have been investigated by means of x-ray photoemission spectroscopy. This study shows that the electronic structures of ThO_2 and UO_2 are quite similar, except for the presence of 5f electrons in UO_2 which lie close to the Fermi level. It is these low-binding-energy 5f electrons that give rise to the most dramatic differences in physical properties, notably the magnetism, electrical conductivity, and color. Conduction in UO_2 apparently occurs via holes created by excitation of rather localized 5f electrons from the uranium to interstitial oxygen-acceptor sites. Sputtering experiments on thin oxide film and bulk samples show Fermi-level shifts in x-ray photoemission spectra associated with doping changes that result from preferential removal of interstitial ("impurity") oxygen atoms. The deep-trap and polaron conduction models have been reexamined. It is our view, at this time, that neither model can be ruled out. For the pure metal thorium, valence-band spectra were compared with the available density-of-states calculations and satisfactory agreement was obtained. For α-uranium, no detailed band calculation exists. However, the results agree with the qualitative density-of-states picture presented by Friedel. (auth)

Metals and Alloys

Refer also to abstract 12930.

11866 (AECL-4842) MATERIALS RESEARCH IN ATOMIC ENERGY OF CANADA LIMITED. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Sum 1974. 26p. Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

Research programs are summarized on dynamic elastic properties of materials, effects of aging and irradiation on corrosion of Zr-2.5 wt.% Nb, creep resistance of Zr-2.5 wt.% Nb, strengthening of Zr alloys, fracture of 403 stainless steel, and radiation-induced swelling of UO_2. (JRD)

11867 (RDT-M-5-1T(11-74)) STAINLESS STEEL PLATE, SHEET, AND STRIP (ASME SA-240 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D. C.). Nov 1974. 7p. RSO.

This standard covers Cr and Cr–Ni stainless steel plate, sheet, and strip for nuclear and associated applications. Included are general requirements, basis of purchase, additional requirements; application supplements, and optional provisions for treatment, analysis, testing, etc. (DLC)

11868 (RDT-M-7-3T(11-74)) STAINLESS STEEL BARS AND SHAPES (ASME SA-479 WITH ADDITIONAL REQUIREMENTS). (USAEC Division of Reactor Research and Development, Washington, D. C.). Nov 1974. 7p. RSO.

This standard supersedes the Oct. 1973 issue of RDT-M-7-3T and covers alloy steel bars and shapes for nuclear and associated applications. General requirements, basis of purchase, additional requirements, application supplements, and optional provisions are given for testing. Both ferritic and austenitic steels are covered. (DLC)

11869 METALS RESOURCES: TUNGSTEN. Miller, J. R. J. Metals; 25: No. 9, 222-223(Sep 1973).

This is a summary of part of the UN Report "Prospects for Further Processing of Selected Mineral Reserves." Tables are included giving the estimated global W reserves, mine production, consumption, price, and future trends in W usage. The nearly 7-to-1 ratio of Mo-to-W usage in USA and its reversal in other industrialized countries are pointed out. (DLC)

11870 TANTALUM TAKES ON NEW APPLICATIONS. Jenstrom, E. R.; Schussler, M. (Fansteel Inc., Metuchen, NJ). Metal Progr.; 106: No. 7, 67; 70-71(Dec 1974).

Ta is being used in the chemical process industry as well as the electronics industry. Effects of welding, redrawing, and annealing on the properties of tubes of Ta and Ta–2.5W–0.15Nb are tabulated. Typical high-temperature properties of commercial Ta and its alloys (Ta–10W, Ta–7.5W, Ta–2.5W–0.15Nb, Ta–8W–2Hf, and Ta–10W–2.5Hf–0.01C) are also tabulated. Various applications of Ta alloys (Fansteel 63, etc.) in the chemical process industry are described. (DLC)

Corrosion and Erosion

Refer also to abstracts 10630 and 10698.

11871 (BLG-491) ASSESSMENT OF THE CORROSION RESISTANCE OF AISI 316 IN IMPURE HELIUM. Van Asbroeck, P.; Willermoz, H.; Tas, H. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Sep 1973. 14p. Dep. NTIS (U. S. Sales Only) $4.00.

The available data on AISI 316 steel corrosion in helium atmosphere have been reviewed. The corrosion behavior is governed more by the concentration of water vapor than its partial pressure. With pH_2/pH_2O ratios of approximately 10, the attack at 700°C increases significantly with water concentration in the range 1 to 3 vol. ppM but is less dependent over the range 5 to 10 vol. ppM. The attack decreases as the pH_2/pH_2O ratio increases above 10. The kinetics vary with the degree of attack, being either directly proportional to time of exposure (t) or proportional to $t^{\frac{1}{2}}$. A pessimistic linear extrapolation of the data (for a pH_2/pH_2O ratio of 10 and 1 to 2 vol. ppM H_2O) from 6000 h exposure to 3 years predicts a total attack lower than 25 μm up to 780°C. At 700°C it is divided equally between general-scale formation and intergranular penetration, although at higher temperatures intergranular attack appears to be dominant. (auth)

11872 (CEA-R-4609) FORMATION AT HIGH TEMPERATURE AND UNDER OXYGEN PARTIAL PRESSURE OF A CORROSION-RESISTANT OXIDE LAYER ON URANIUM. Contribution to Uranium Oxidation Research. Bruyere, B. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92–Montrouge (France)). Oct 1974. 81p. (In French). Dep. NTIS (US Sales Only) $7.25.

Such a layer has been obtained by heat treatment at 625°C under oxygen partial pressure, according to the directions of G. S. Petit, R. R. Wright, C. A. Kienberger, and C. W. Weber. No corrosion is observed on uranium samples coated with a 20 to 30 micron oxide layer and exposed for several hundred hours in a corrosion oven at 70°C and 100% relative humidity. Examination of the layers shows a UO_2-type oxide substoichiometric in oxygen, belonging to the type n semiconductor category. The oxide layer grows by electron diffusion under the effect of an oxygen concentration gradient, due to an oxygen composition variation in the layer. (11 tables, 32 figs, 35 references) (auth)

11873 (DP-MS-74-25) TRITIUM ABSORPTION IN 304L STAINLESS STEEL. Louthan, M. R. Jr.; Donovan, J. A.; Caskey, G. R. Jr. (Du Pont de Nemours (E. L) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1974. Contract AT(07-2)-1. 48p. (CONF-741036-2). Dep. NTIS $5.50.

From AIME-IMD symposium on materials for controlled thermonuclear reactor systems; Detroit, Michigan, USA (21 Oct 1974).

Tritium diffusivities at temperatures greater than 373°K were shown to be in excellent agreement with the equation for deuterium $D = (1/\sqrt{m})\ (4.7 \times 10^{-3})\ \exp(-12{,}900/RT)\ cm^2\ sec^{-1}$, where m is the isotopic mass. Evidence for "short-circuit" diffusion paths and a grain size effect on tritium absorption is also presented. Cold work, either prior to or during exposure, increased the effective tritium diffusivity. The increase in the samples cold-worked prior to exposure is believed to be caused by preferential (short-circuit) diffusion through strain-induced martensite, while that in specimens deformed during exposure is believed to be caused by enhanced tritium transport with moving dislocations. Analysis of concentration gradients also shows that tritium permeation rates through austenitic stainless steels will often be less than rates expected from analysis of diffusion-controlled transport properties because of surface barriers that limit tritium absorption, even at pressures to 69 Mpa. Solubilities derived from the analyses were consistently lower than expected and are influenced by specimen surface conditions. (10 fig., 22 references) (DLC)

11874 (KFK-2051) INTERGRANULAR CORROSION EXPERIMENTS OF INCONEL ALLOY 600 IN SUPERHEATED STEAM AFTER DIFFERENT THERMAL AND THERMO-MECHANICAL PRETREATMENTS. Leistikow, S.; Wurster, W. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Sep 1974. 32p. (In German). Dep. NTIS (US Sales Only) $4.75.

Experiments (1000 h, 600°C, 70 atm) were performed in superheated steam using electropolished sheet specimens of different grain sizes as well as different thermal and thermo-mechanical pretreatments: as-received; solution-annealed; solution-annealed + short-time precipitation-annealed; solution-annealed + long-time precipitation-annealed; solution-annealed + short-time precipitation-annealed + cold deformed + recrystallization annealed. After steam corrosion of Inconel 600 in all special pretreated conditions, no intergranular oxidation besides general surface oxidation could be detected. The extent of general corrosion was influenced by structural conditions of the bulk of the metal as size and distribution of precipitations and grain size. These findings could be explained on the basis of easy diffusion of Cr along the grain boundaries, as effects of favored precipitation and formation of corrosion-sensitive Cr-depleted seams at the grain boundaries. Exposure of thermo-mechanically pretreated tube material to steam corrosion under superimposed tensile stresses (1000 and 2000 h, 650°C, 162 atm, 9.6 $kp/mm^2 = 94\%\ \sigma_{B1000}$) resulted in an insignificant intergranular surface attack with no tendency to further penetration in depth or damage-producing action. Thus it was shown that the rupture-life was not reduced by steam oxidation. (11 fig) (auth)

11875 (MLM-2180(OP)) OXIDATION MECHANISM STUDIES OF T-111 ALLOY BY PLUTONIUM-238 DIOXIDE. Teaney, P. E.; Selle, J. E. (Mound Lab., Miamisburg, Ohio (USA)). [nd]. Contract AT-33-1-GEN-53. 16p. (CONF-740812-6). Dep. NTIS $4.00.

From 7th annual international Metallographic Society technical conference; Gatlinburg, Tennessee, USA (4 Aug 1974).

Mechanisms of O transport to the T-111 liner were studied. It was found that more oxygen uptake occurred in the heat source liners due to vapor-phase transport than could be accounted for by the Langmuir equation. This is most likely due to the presence of volatile oxide impurities in the fuel. Also, oxidation of the liner occurs primarily by solid-state diffusion and secondarily by vapor-phase transport. (auth)

11876 (SAND-74-6020) INVESTIGATION OF PREIGNITION PROCESSES IN ZIRCONIUM, TITANIUM, AND ZIRCONIUM HYDRIDE. Ziobinskii, B. M.; Mal'tsev, B. M.; Kurylev, V. V. Translated from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; 16: No. 3, 114-116(1973). 5p. Dep. NTIS $4.00.

Experiments were carried out on particles of electrolytic zirconium (99.96% Zr), magnesiothermic titanium (94.6% Ti), and zirconium hydride (ZrH_2). The oxidation proceeds according to the scheme: dehydrogenation of the grain surface, interaction of the metal with oxygen, and interaction of the metallic oxide with hydrogen. The oxidation mechanism operates during the entire heating process. This explains the relatively small increase in the diameter of the zirconium hydride grains. Confirmation of this mechanism is also found in the decrease of the grain diameter during cooling as a result of the continuing decomposition of the hydride. After cooling, the zirconium hydride grains have the color of zirconium oxide. (auth)

11877 (WARD-NA-3045-15) SODIUM TECHNOLOGY PROGRAM COMPONENT MATERIALS COMPATIBILITY. Quarterly Progress Report for Period Ending July 31, 1974. Ray, W. E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1974. Contract AT(11-1)-3045. 45p. AT.

Research activities are summarized on carbon and nitrogen transfer in liquid metal circuits and on the effects of flowing sodium on the mechanical properties of reactor materials. (JRD)

11878 INTERNAL OXIDATION AND MECHANICAL PROPERTIES OF TZM–Mo ALLOY. Liu, C. T.; Inouye, H. (Oak Ridge National Lab., TN). Met. Trans.; 5: No. 12, 2515-2525(Dec 1974).

The internal oxidation behavior of the bcc alloy TZM-Mo was investigated in low-pressure O_2, CO, and H_2O at 1098 and 1273°K. Results indicate that a diffusion process controls the kinetics of the oxygen absorption at 1098°K, while bulk diffusion and gas-metal interaction at the specimen surface both affect the rate at 1273°K. The carbon content of TZM increased initially and then decreased. Decarburization became significant only after extended exposure at 1273°K. The deformation and fracture behavior of both oxidized and heat-treated TZM specimens were studied at temperatures to 1589°K. TZM specimens showed an increase in strength and a linear decrease in ductility with oxygen content. Oxidized TZM lost its ductility completely at an oxygen level of 300 ppM at room temperature, 1366, and 1589°K, but 500 ppM was required at 1098°K. The ductility of embrittled TZM was increased significantly with heat treatment at high temperatures and was almost completely restored after annealing at 1973°K. The change in mechanical properties is discussed in terms of internal oxidation and precipitation of oxides. (15 figures, 5 tables) (auth)

11879 OXIDATION OF NIMONIC 80A IN OXYGEN AT REDUCED PRESSURE. Hales, R.; Hill, A. C. (Berkeley Nuclear Labs., Eng.). Corros. Sci.; 14: No. 9, 553-562(Oct 1974).

The oxidation of Nimonic 80A in the temperature range 1048 to 1143 K in oxygen at pressures in the range 2×10^{-7} to 1.5×10^{-4} torr was studied by weight gain measurements. Initially the reaction proceeds according to a linear rate law and subsequently follows a parabolic law. These observations are discussed in terms of the formation of two titanium oxides on the metal surface. Metallographic examination of the oxidized metal showed grain boundary attack in the metal substrate. The reaction product found in the metal grain-boundaries was a mixed oxide of aluminium and titanium. (auth)

11880 STUDY OF ADHESION INTERACTION OF MOLYBDENUM WITH MOLYBDENUM PROTECTED WITH REFRACTORY COMPOUND COATINGS. Samsonov, G. V.; Evtushenko, O. V.; Braun, S. M. (Inst. of Problems in Materials Science, Kiev). Dopov, Akad. Nauk Ukr. RSR, Ser. A; No. 10, 953-955(Oct 1974). (In Ukrainian).

The adhesion interaction of Mo with Mo protected with boride, carbide, and silicide coatings was studied at 800 to 1200°C. Boriding, carbidizing, and siliconizing of molybdenum are shown to decrease its adhesion ability in the interaction with pure Mo. (auth)

Preparation and Fabrication

11881 (COO-1790-5) "IN-SITU" ELECTRON MICROSCOPE INVESTIGATION OF THE NUCLEATION AND GROWTH OF SPUTTERED THIN FILMS. Annual Technical Progress Report V. Hutchinson, T. E.; Maa, J.; Lee, J. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). 30 Jan 1973. 49p. Dep. NTIS $5.50.

Results of investigations on nucleation and growth of sputtered thin films inside electron microscopes are presented. Data and information are included on Nb deposition on graphite and mica, Si deposition on graphite, Ag deposition on Si, and Si deposition on Si. A description of the ultrahigh vacuum deposition system is included. (JRD)

11882 REFRACTORY PERFORMANCE IN ELECTRIC-ARC FURNACES FOR SMELTING FERROVANADIUM. Bas'yas, I. P.; Sizov, V. I.; Kolpakov, L. E.; Reshetnikov, N. A.; Belyaev, R. A. Refractories (USSR) (Engl. Transl.); 15: No. 1-2, 98-102(1974).

Translated from Ogneupory; 15: No. 2, 27-31 (Feb 1974).

The demanding service conditions on the refractories in the DS-3 electric-arc furnace for smelting ferrovanadium cause the lining to wear out rapidly. The service behavior of magnesia refractories varies with the location in the furnace. Brick of the MKhS type in the well and slag belt wears 15-20% faster and periclase-spinel brick in the well 10-15% slower than magnesite refractories. The life of the well lining can be increased 25-30% by covering the lining with a rammed layer of fused magnesite powder. Patching the walls with this powder after every melt in the second half of the campaign makes it possible to regulate the wear of the batters so that it matches the wear of the well. A layer of lime placed in the well prior to charging the metal residue protects the exposed refractory from the corrosive agents during smelting and reduces lining wear. A roof of chrome–magnesite brick is two to three times more durable than a magnesite roof. (4 fig, 4 tables) (auth)

11883 FILLER ALLOYS FOR FLUXLESS BRAZING ALUMINUM AND ALUMINUM ALLOYS. Werner, W. J. (to United States Atomic Energy Commission). US Patent 3,844,777. 29 Oct 1974. Filed date 4 Oct 1972. 4p.

A fluxless brazing alloy is described for forming brazed composites from aluminum and its alloys. The brazing alloy consists of 1–10% Y, 15–30% Ge, and balance Al; 1–10% Y, 17–30% In, and balance Al; 58–70% Ag, 10–12% In and balance Al; 35–40% Ag, 38–47% Ge, 13–16% Al. (Official Gazette)

11884 EFFECT OF AN EXTERNAL ELASTIC STRESS ON THE PRECIPITATION BEHAVIOR OF A Fe–Mo–Au ALLOY. Sauthoff, G. (Max-Planck Institut fuer Eisenforschung, Duesseldorf). Phys. Status Solidi (a); 26: No. 1, K5-K7(16 Nov 1974).

In order to study the orienting of Au platelets, single crystals of Fe–3 at.% Mo–0.9 at.% Au were heat treated with variations of the initial subcooling, isothermal aging time, and stress application times. Results indicate that a short application of a ⟨100⟩ tensile stress during homogeneous nucleation is not sufficient for stress orienting the Au particles; the stress must also be present during particle growth and the beginning of coarsening as long as the particles are not completely incoherent. (DLC)

11885 METHOD FOR PREPARING SCANDIUM METAL. Schmidt, F. A.; Carlson, O. N. (to United States Atomic Energy Commission). US Patent 3,846,121. 5 Nov 1974. Filed Date 12 Jan 1973. 6p.

High-purity scandium metal is prepared from scandium oxide by firing the scandium oxide in air to remove any volatile residual material and free carbon which may be present, chlorinating the fired oxide with phosgene to scandium chloride, and reducing the scandium chloride with magnesium, calcium, or mixtures thereof to scandium metal. The metal may then be further purified by vacuum distillation or arc-melting. (Official Gazette)

11886 PROCESS OF JACKETING FUEL ELEMENTS. Ray, W. E.; Sprowl, J. D. (to United States Atomic Energy Commission). US Patent 3,849,867. 26 Nov 1974. Filed Date 2 Oct 1957. 4p.

A process is given for integrally bonding a jacket of zirconium metal to a uranium core. The method comprises applying a layer of iron onto said core, immersing the jacket into molten zinc chloride of a temperature of between about 410 and 460°C, and assembling said core and said jacket while both are immersed in a molten aluminum–silicon alloy. (Official Gazette)

11887 STUDIES ON INTERNAL WELDING OF SMALL-SIZE TUBES. Kurebayashi, S.; Shimizu, S.; Aota, T.; Nagai, K. (Kawasaki Heavy Industries, Ltd., Kobe, Japan). Karyoku Genshiryoku Hatsuden; 25: No. 3, 254-264(Mar 1974). (In Japanese).

There are many tube–tube plate connections in heat exchangers in nuclear power plants and feed heaters in thermal power plants, and most of these tubes are small-size and thick tubes. If conventional welding methods are employed for the welding of these tube–tube plate connections, nondestructive inspection cannot be applied after the welding so that high quality welding cannot be expected. Instead, the following method can be used. The stubs corresponding to tubes are fabricated on tube plates, and the butt joints of the stubs and the tubes are automatically welded by TIG from inside. This method can make the radiation inspection of weld parts possible and can yield high quality tube–tube plate welded joints. In case when the difference between the gas pressure inside and outside tubes is zero, good and reproducible welded parts can be acquired by horizontal position welding, but

good result cannot be expected by all position welding. In case when there exists gas pressure difference, extremely good welded parts can be reproduced by controlling the difference between the gas pressure inside and outside tubes. When the internal welding of small-size tubes is performed, it is very effective to control arc voltage by taking into consideration the composition of shield gas. After the welding of full-size tube–tube plate joints in a steam generator for a fast breeder reactor, each welded part was found to satisfy the requirement of JIS Z 3104 first class. (JA)

11888 SMALL-SCALE METALLURGICAL INDUSTRIES TO MEET THE NEEDS OF EDUCATIONAL AND RESEARCH INSTITUTIONS. Ramachandran, T. Technomet; 2: 29-36(1973).

The potential for small industries in India to supply special materials to research and teaching institutions is discussed. Three classes of metals are considered: pure metals, single crystals, and metal powders. The metals covered include U, Be, Mo, Zr, etc. Production of materials require relatively little capital but high technical skill. (7 tables) (DLC)

11889 PROSPECTS OF SMALL SCALE SURFACE TREATMENT INDUSTRIES IN INDIA. Balachandra, J. (Bhabha Atomic Research Center, Trombay, India). Technomet; 2: 37-41(1973).

There have been considerable advances in the metal finishing industry. This has been possible largely due to the emergence of new technologies in the field of electronics, space, nuclear engineering, and computers. This paper briefly reviews new developments in the application of some of the metal finishing processes and the possibility of starting a metal finishing plant in the small-scale industries sector. Approximate figures for investment, output, and anticipated return are included. With the growth of the industrial sector in india, the prospects of such a venture are bright. The role of research organizations and technical associations in the development of the metal finishing industry is emphasized. (auth)

11890 PROSPECTS FOR SMALL SCALE INDUSTRIES IN THE FIELD OF METALS: CECRI CONTRIBUTION. Udupa, H. V. K. (CECRI, Karaikudi, India). Technomet; 2: 42-46(1973).

R & D conducted by the CECRI on the fields of producing metals, metal powders, and metal refining are reported. Misch metal is among the materials whose production in India is discussed; others are Na, Ca, Sn, Zn, Fe, Cu, etc. (DLC)

11891 REPROCESSING OF TUNGSTEN WASTES BY ELECTROLYTIC REFINING IN SALT MELTS. Balikhin, V. S.; Pavlovskii, V. A.; Reznichenko, V. A. Tsvetn. Metal.; No. 10, 59-62 (Oct 1974). (In Russian).

Technology for the refining of W in melts containing 60% NaCl, 15% NaF, and 25% WO_3 was developed. Electrolysis was carried out at 870 ± 20°C, with D_a = 0.10 to 0.14 A/cm², and D_c from 0.3 to 2 A/cm². The technology was developed on a semi-industrial installation with a productivity of 5 kg/day. A scheme was proposed for the reprocessing of W wastes by electrolysis with soluble anode. (tr-auth)

11892 METHOD OF FABRICATING A COMPOSITE MULTIFILAMENT INTERMETALLIC TYPE SUPERCONDUCTING WIRE. Suenaga, M.; Sampson, W. B.; Crow, J. E.; Gurinsky, D. H. (to United States Atomic Energy Commission). US Patent 3,838,503. 1 Oct 1974. Filed date 12 Jul 1972. 8p.

Thin, brittle, Type-II superconductors in a matrix formed by preparing and cold working without annealing one axially aligned element of a two-component hard superconductor in a pure copper sheath to form a composite assembly of multifilamentary wires in a copper matrix at the desired final size and shape, coating the matrix with the other component of the superconductor, and diffusing the coating completely through the matrix into the wires to form the desired intermetallic superconductor in the matrix. Intermetallic superconductors found to be useful are Nb_3Sn, V_3Ga, and V_3Si. (Official Gazette)

11893 INVESTIGATION INTO THE PROCESS OF CROSS ROLLING OF MOLYBDENUM AND NIOBIUM. Kilikov, A. P.; Krupin, A. V.; Chernyshev, V. N.; Potapov, I. N.; Gladkov, V. I.; Tarasov, K. K. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 1, 90-92(1974). (In Russian).

For English translation see the journal Stal USSR.

The process of cross rolling of Mo obtained by electroarc fusion with subsequent deformation by plasma fusion and of Nb samples obtained by electron-beam fusion with subsequent forging was studied by the powder metallurgy method. The substantial effects of the technological parameters and the conditions of smelting of the original metal (Mo) and the rolling conditions on the energy parameters of the process of cross rolling are discussed. (tr-auth)

11894 SINGLE CRYSTAL PREPARATION OF RARE EARTH-COBALT INTERMETALLIC COMPOUNDS BY A BN-COATED CRUCIBLE. Katayama, T.; Shibata, T. (Electrotechnical Lab., Tanashi, Tokyo (Japan). Tanashi Branch). J. Cryst. Growth; 24-25: 396-399(Oct 1974).

From fourth international conference on crystal growth; Tokyo, Japan (24 Mar 1974).

A preparation method for single crystals of RCo_5 and $R_2(Fe_xCo_{1-x})_{17}$ by a Bridgman technique using a BN-coated crucible is presented, where R denotes Y, Pr, Nd, Sm, and Gd. The grown single crystals are about 13 mm in diameter and 50 mm long. The single crystals of RCo_5 and $R_2(Fe_xCo_{1-x})_{17}$ where R has a low vapor pressure at high temperatures such as Y, Nd, and Gd tend to grow more easily. The growth of single crystals such as $SmCo_5$ and Sm_2Co_{17} is more difficult because of the high vapor pressure of Sm. Some magnetic properties are described for the $Y_2(Fe_xCo_{1-x})_{17}$ (x = 0-0.5) system as an example. (auth)

11895 PREPARATION OF CADMIUM, ZINC AND MAGNESIUM SINGLE CRYSTALS OF HIGH CRYSTALLINE PERFECTION. G'Sell, C.; Champier, G.; Iwasaki, Y. (Ecole Nationale Superieure de la Metallurgie et de l'Industrie des Mines, 54–Nancy (France). Lab. de Physique du Solide). J. Cryst. Growth; 24-25: 527-530(Oct 1974).

From fourth international conference on crystal growth; Tokyo, Japan (24 Mar 1974).

A solidification technique is described for preparing flat metallic single crystals of hexagonal structure. Their examination by transmission X-ray topography shows that cadmium and zinc specimens can be obtained with a very low density of dislocations. Magnesium crystals can also be prepared, but of a lower quality. A study of the origins of the dislocations during crystallization from the melt accounts for the experimental results. (auth)

11896 GROWTH OF NIOBIUM SINGLE CRYSTALS BY A PEDESTAL METHOD. Naramoto, H.; Kamada, K. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). J. Cryst. Growth; 24-25: 531-536(Oct 1974).

From fourth international conference on crystal growth; Tokyo, Japan (24 Mar 1974).

Niobium single crystals of very high perfection were grown by a pedestal method with electron beam bombardment. The quality of the single crystals was assessed by taking both projection and section X-ray topographs with [$\bar{1}$01], [101], [020] and [0$\bar{2}$0] reflections. Elastic lattice distortions were identified by the change of image contrast which depends on the diffraction vector. No dislocation images were observed around the lattice distortions near a blob of scum on the surface, implying that larger stresses are necessary in bcc crystals than in fcc crystals to generate dislocations. Elastic lattice distortions which originate from planar defects were still present in the bottom part of the crystal. However, no dislocation images were observed in this region. Some comments are given on how to improve the growth conditions in order to grow more perfect niobium crystals. (auth)

11897 THE GROWTH OF GADOLINIUM SINGLE CRYSTALS DURING SOLID STATE ELECTROTRANSPORT PROCESSING. Jordan, R. G.; Jones, D. W.; Hall, M. G. (Birmingham Univ. (UK)). J. Cryst. Growth; 24-25: 568-571(Oct 1974).

From fourth international conference on crystal growth; Tokyo, Japan (24 Mar 1974).

Crystal growth techniques based on solid state electrotransport processing for Gd and certain other rare earth metals are described. A technique involving melt growth followed by solid state processing has been developed which produces large, high purity, good quality crystals of controlled orientation. The resultant crystals are, to date, superior to those produced by other methods. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 11865, 12729, 12731, 12733, 12734, 12736, 12737, 12739, 12823, 13181, and 13189.

11898 (AD-780596) MATERIALS RESEARCH IN SUPPORT OF SUPERCONDUCTING MACHINERY. Semiannual Report, 1 September 1973–1 March 1974. (National Bureau of Standards, Boulder, Colo. (USA)). Mar 1974. 567p. (NBSIR-74-359). NTIS $10.75.

Results of six months research are reported. Subjects include magneto-thermal conductivity, thermal conductivity, composites, elastic properties, fracture toughness, fatigue, and tensile. All measurements include the temperature range 4 to 300°K. Materials examined are those either presently being used in superconducting machinery or considered for use in future prototypes. Material classes include stainless steels, inconels, titanium al-

loys, and composites. Special results include: the thermal conductivity in a magnetic field is considerably lower than would be predicted; a comprehensive review of glass-reinforced composite behavior at low temperatures is included; the elastic moduli of 12 engineering alloys from 4 to 300°K are reported; and fracture toughness and fatigue crack growth rate data on AISI 304. AISI 316, A286, Ti-5AL-4V and Ti-6AL-2.5SN at 4, 76 and 300°K have been measured. (GRA)

11899 (AD-780903) INVESTIGATION OF FLUX PINNING AND CRITICAL CURRENT DENSITIES IN TYPE II SUPERCONDUCTORS. Technical Report, 1 July 1973-30 June 1974. Deis, D. W.; Mathur, M. P.; Ashkin, M.; Jones, C. K. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 20 Jun 1974. Contract N00014-73-C-0026. 53p. NTIS $3.75.

Magnetization measurements, M(H,T) were made on a series of Nb and NbTi multifilament conductors as well as a series of heat treated monofilament Nb-25%Zr conductors. From these measurements the pinning force (F_P) (H,T) and the critical current characteristics, (J_C) (H) are deduced for all samples. The scaling law theory of flux pinning was found to be valid, in general, for all these materials. Metallurgical examinations have been made on the Nb-Zr samples to relate heat treatment, J_C and microstructure. (GRA)

11900 (AD-781135) HIGH CRITICAL TEMPERATURE-HIGH FIELD SUPERCONDUCTORS. Final Report, 1 July 1971-30 July 1974. Deis, D. W.; Gavaler, J. R.; Reynolds, W. T. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 1 Jul 1974. Contract F44620-71-C-0045. 13p. (AFOSR-TR-74-0989). NTIS $3.00.

Investigations of new bulk and thin film conductor materials with the A-15 structure have yielded several new high transition temperature compounds. The most significant of these was thin film niobium-germanium prepared by a new sputtering technique. Under the proper sputtering conditions films have been deposited with the highest transition temperature, 23°K, of any presently known superconductor. In addition, techniques and apparatus have been devised, constructed and tested for the assembly, consolidation, cold drawing and heat treatment of composite multifilamentary conductors employing niobium, tin, vanadium, and gallium. The superconducting and metallurgical properties of a number of these conductors were extensively investigated. (GRA)

11901 (AD-781802) RESEARCH AND DEVELOPMENT ON CHARACTERIZATION OF ELECTROMAGNETIC MATERIALS. Yearly Progress Report, 1 May 1972-30 April 1973. Earley, D.; Franklin, P.; Harris, R.; Stevens, S. (Dayton Univ., Ohio (USA). Research Inst.). Feb 1974. Contract F33615-72-C-1666. 70p. (UDRI-TR-74-05). NTIS $3.75.

Experimental work was conducted on the thermodynamic properties of several materials including samarium, cobalt, zinc selenide, cadmium telluride and mercury cadmium telluride. Isotopic intensities were determined on several isotopes and the results shown graphically. The second and third law thermodynamic properties were calculated from accumulated data and the tabulated results are included, even though the thermodynamic properties of mercury cadmium telluride were not obtained. A discussion is given on some observations made during test runs and results of chemical analyses are shown. Several organic laser dye materials and liquid crystal materials were synthesized and investigated. The synthesis routes to these materials are detailed and the characterization results of the materials presented in tabular form. (GRA)

11902 (AD-782028) THERMODYNAMICS OF CHEMICAL SPECIES IMPORTANT TO ROCKET TECHNOLOGY. Final Report, January-June 1973. Douglas, T. B.; Beckett, C. W. (National Bureau of Standards, Washington, D. C. (USA)). 1 Jul 1973. 123p. (NBSIR-73-281; AFOSR-TR-74-0063). NTIS $4.75.

Using a subsecond-duration transient technique, the specific heat, electrical resistivity, and hemispherical total emittance were simultaneously measured over the temperature range 1500 to 2800°K for iron and for the alloy 80 Nb-10 Ta-10 W. The work on iron demonstrates the feasibility of applying a rapid-pulse heating technique to solid-solid transformations. Melting points (and normal spectral emittance for 650 nm at the melting point) were found. Preliminary values are reported for the first time for the standard heat of formation and a vapor pressure of the subfluoride of molybdenum MoF_5. A new static method for measuring small vapor pressures has reproduced known values for I_2 and MoF_6 to within 1%. The vapor pressure of MoF_5 (L) thus measured at 393°K, when compared with the earlier transpiration result for this temperature, indicates that the saturated vapor contains about 85 or 90 mole % of the monomer species, depending on the method of interpretation. (GRA)

11903 (AD-782094) THERMODYNAMICS OF CHEMICAL SPECIES IMPORTANT TO ROCKET TECHNOLOGY. Final Report. Douglas, T. B.; Beckett, C. W. (National Bureau of Standards, Washington, D. C. (USA)). 1 Jan 1973. 111p. (AFOSR-TR-74-0062). NTIS $4.50.

The enthalpy of high-purity molybdenum was accurately measured 273 to 1173°K, and joined smoothly to lower-temperature (German) and higher-temperature (NBS) results to give thermodynamic functions at 273 to 2100°K. The heat capacity of a grade of POCO graphite was measured by a subsecond-duration pulse-heating technique at 1500 to 3000°K (estimated inaccuracy, 3% or less). Based largely on earlier NBS ir and Raman spectroscopy, ideal-gas thermodynamic functions for MoF_5 were generated and are tabulated for 0 to 6000°K. Three alternative classical-thermodynamic or quasi-chemical treatments are developed for deriving thermodynamic properties from vaporization data on partially associated vapors, with calculations to illustrate experimental-error propagation for one treatment. A subsecond-duration pulse-heating technique was applied to niobium metal to measure its change in normal spectral emittance and radiance temperature at and near its melting point (wavelength, 650 nm), studying dependence on solid-state roughness (0.1 to 0.95 micrometers). (GRA)

11904 (AD-782573) RESEARCH IN MATERIALS SCIENCE. Semiannual Technical Report No. 2, 1 January-30 June 1974. Epstein, D. J.; Rose, R. M.; MacVicar, M.; Lagow, R.; Pelloux, R. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Materials Science and Engineering). 30 Jun 1974. Contract DAHC15-73-C-0316. 183p. NTIS $5.50.

The report presents the results and status of work after the second six month period of work on this research program. The work consists of five separate tasks involving research in materials science; namely: optoelectronic materials and components; miniaturized and thin film laser sources and modulators; superconducting transition metal alloys; chemical synthesis using high temperature lithium vapor species; fatigue and fracture properties of austenitic steels; and, materials characterization using light scattering spectroscopy. (GRA)

11905 (AD-782887) POSITRON, ELECTRON, AND PHOTON INTERACTION EXPERIMENTS. Final Report, 15 December 1961-15 December 1972. Berko, S. (Brandeis Univ., Waltham, Mass. (USA). Dept. of Physics). 1974. 10p. (AROD-3389.21-P). NTIS $3.00.

The research involved the development and application of the positron annihilation technique to various aspects of solid state physics. The experiments performed can be divided into three categories: (1) high precision angular correlation measurements; (2) 3-gamma/2-gamma yield measurements; and (3) lifetime experiments. Materials studied included V_3Si, Cu, and Cu-Al alloys, V_2O_3 and quartz. (auth)

11906 (BNL-19166) DIFFUSION MECHANISMS FOR THE GROWTH OF Nb_3Sn INTERMETALLIC LAYERS. Farrell, H. H.; Gilmer, G. H.; Suenaga, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 30p. (CONF-740827-2). Dep. NTIS $4.50.

From international conference on low temperature diffusion; Yorktown Heights, New York, USA (12 Aug 1974).

The effects of increasing the Sn concentration in niobium bronze were studied. It was found that simple grain boundary diffusion should lead to compound formation with a parabolic time dependence. However, when other factors enter in, such as grain growth, reduction in chemical potential or any other factor that reduces the flux to the growth interface, the time dependence can fall below a $t^{0.5}$ power law. Conversely, when factors such as interface kinetics become dominant either through crack formation or a suppression of the grain size, the growth rate may exceed a parabolic time dependence and actually approach a linear time dependence under optimal circumstances. The layer of Nb_3Sn at a Nb-(Cu-Sn) interface has proven to be a versatile system in that it can be made to display a variety of growth mechanisms by minor modifications of the Sn concentration in the bronze or by doping the starting material. (auth)

11907 (BNWL-SA-5060) HIGH-RATE SPUTTERING OF Nb-Al-Ge AND Nb-Al SUPERCONDUCTORS. Dahlgren, S. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 14p. (CONF-740950-1). Dep. NTIS $4.00.

From conference on applied superconductivity; Argonne, Illinois, USA (30 Sep 1974).

High quality Nb-Al-Ge and Nb-Al superconductor deposits were made at a rate of 1 μm/min using high-rate sputtering techniques. Deposits were up to 1 mm thick. High-rate sputtering reduced fabrication difficulties and significantly increased current capacities. Sputtering equipment capabilities indicate reasonable quantities of high field superconductors can be made by high-rate sputtering for practical application. The Nb-Al-Ge and Nb-Al

deposits were of high quality as indicated by highly reflective metallic mirror surfaces, even in thicknesses up to 1 mm. Moreover, the deposits were completely void-free and they did not seem to be overly brittle either before or after heat treatment. Crystal structures for deposits made at 10°C to 20°C were not clearly defined, but probably were body-centered-cubic (bcc). Heat treatment at 550°C to 850°C completely transformed the bcc deposits to extremely small grains of the A-15 crystal structure. The A-15 phase formed by heat treatment for short times (e.g., 1 hr to 5 days) at 750°C was metastable and supersaturated with Al and Ge. Deposition and heat conditions for decomposition of the metastable A-15 phase were identified. The deposits having the highest critical temperatures (18°K) consisted only of undecomposed metastable A-15 phase. In order to assess practical use of the sputtered superconductors, one- to two-meter lengths of ribbon and filamentary Nb–Al–Ge superconductor were produced on ribbon and wire substrates. It also was found that an excellent superconductor-stabilizer bond can be formed by high rate sputter-deposition of copper stabilizer onto heat treated Nb–Al–Ge and Nb–Al superconductors. (auth)

11908 (CALT-822-64) SUPERCONDUCTIVITY IN AMORPHOUS AND MICROCRYSTALLINE TRANSITION METAL ALLOYS. Johnson, W. L.; Poon, S. J. (California Inst. of Tech., Pasadena (USA). W. M. Keck Lab. of Engineering Materials). Sep 1974. Contract AT(04-3)-822. 25p. Dep. NTIS $4.50.

Results of x-ray diffraction, electrical resistivity, critical magnetic field, and transport measurements for several bulk amorphous and microcrystalline transition metal superconductors obtained by liquid quenching are presented and discussed. Simple J_c-H_{c2}-T_c relations are observed for this class of materials. A linear relation between electronic diffusivity and nearest neighbors distance is derived from critical field measurements. The relationships between the formation of an amorphous phase by rapid cooling from the liquid state, the lattice stability and the characteristics of phase diagrams are discussed. (auth)

11909 (CONF-741002-P2) PROCEEDINGS OF THE 11TH RARE EARTH RESEARCH CONFERENCE, OCTOBER 7–10, 1974, TRAVERSE CITY, MICHIGAN. Volume I. Sessions K Through W. Haschke, J. M.; Eick, H. A. (Eds.). (Michigan State Univ., East Lansing (USA)). 1974. 662p. Dep. NTIS $13.60.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

Of the ninety papers presented in sessions K through W, separate abstracts were prepared for thirty-two. (LK)

For abstracts of individual papers see: 10497, 10531, 10612, 10632–10637, 10781, 11695, 11753–11758, 11910–11922, 12096, and 12097.

11910 (CONF-741002-P2, pp 621-630) ABNORMAL GRAIN GROWTH IN THIN SHEET DYSPROSIUM. Swift, W. M. (Westinghouse Research Labs., Pittsburgh). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The phenomenon of abnormal grain growth, sometimes referred to as secondary grain growth, was observed in thin sheet (0.05 to 0.25 mm) elemental dysprosium after high temperature annealing in the temperature range 1070 to 1200°C. Growth was selective to a (0001) [10$\bar{1}$0] orientation. In several instances grains grew to a length parallel to the sheet rolling direction exceeding 25 mm. Kinetic studies revealed sigmoidal grain growth behavior. It is shown by optical metallography, electron microscopy, and pole figure studies that three factors are primarily responsible for selective (0001) [10$\bar{1}$0] secondary grain growth. These factors are: (1) a small primary grain size; (2) second phase particles located in the primary recrystallized matrix; and (3) a major primary texture component having high angle grain boundaries with respect to (0001) [10$\bar{1}$0] grains in the primary matrix. (auth)

11911 (CONF-741002-P2, pp 642-650) CRYSTAL STRUCTURE OF DyNiSb, DyPtSb AND RELATED COMPOUNDS. Dwight, A. E. (Northern Illinois Univ., De Kalb). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Results are presented of studies of the crystal structure and composition of equiatomic ternary systems R–T–X where R is a rare earth, T is a transition element or Cu, and X is a group III, IV, or V element. Factors controlling the formation of these compounds are discussed and unit cell constants are presented. (JRD)

11912 (CONF-741002-P2, pp 652-661) CONSTITUTION OF THE INTERMETALLIC R–T BINARY SYSTEMS. Khan, Y. (Ruhr Univ., Bochum, Ger.). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Data are presented on the Co-rich part of the rare earth–Co phase diagram along with isostructural compounds found in the corresponding part of the diagrams for systems R–Fe, R–Ni, Th–Fe, Th–Co, Th–Ni, and Pu–Ni. Phase diagrams are included and analyzed. (JRD)

11913 (CONF-741002-P2, pp 733-737) THERMO-ELECTRIC POWER OF $YbAl_2$ AND $YbAl_3$. van Daal, H. J.; van Aken, P. B.; Buschow, K. H. J. (Philips Research Labs., Eindhoven, The Netherlands). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Results of analyses are presented which suggest that the Seebeck coefficients of $YbAl_3$ and $YbAl_2$ can be described as if there were no appreciable differences between the partial contributions S_v, related to the virtual bound states (vbs) ground level, and S_m, related to the excited magnetic level of the Yb-ion electronic states. In the rare-earth elements, S_m-contributions corresponding to resistivity (ρ_m)have been found to have the negative sign with values of not more than $-10\ \mu V/°K$ at 100°K. However, it has been concluded that in $YbAl_2$ and $YbAl_3$, spin-disorder resistivity and asymptotic Curie temperatures are much larger than expected for normal magnetic rare-earth intermetallic compounds. A similar enlargement of S_m, bringing it in the range of S_v, therefore, does not seem impossible. (auth)

11914 (CONF-741002-P2, pp 738-743) KONDO SIDEBAND EFFECTS IN THE SEEBECK COEFFICIENT OF $Ce_{1-x}La_xAl_3$ COMPOUNDS. van Aken, P. B.; van Daal, H. J.; Buschow, K. H. J. (Philips Research Labs., Eindhoven, The Netherlands). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Results of an experimental study of the absolute Seebeck coefficient S of compounds $Ce_{1-x}La_xAl_3$ at temperatures from 4 to 300°K are presented. It is noted that further elaboration of this system, experimentally with regard to resistivity, Seebeck coefficient, and specific heat, as well as theoretically does seem quite fruitful for an understanding of the Kondo sideband phenomenon. (auth)

11915 (CONF-741002-P2, pp 767-776) PHOTOELECTRON SPECTROSCOPY OF RARE EARTH MATERIALS. Carter, F. L. (Naval Research Lab., Washington, DC). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Development of photoelectron spectroscopy with special reference to lanthanides and actinides is reviewed. Discussions and information are included on semiquantitative analysis, effective charge estimates, photoionization, multiplet splitting, auger spectra, and band structure. (JRD)

11916 (CONF-741002-P2, pp 972-981) MAGNETOELASTIC AND RELATED PROPERTIES OF RARE EARTH-Fe_2 INTERMETALLIC COMPOUNDS. Clark, A. E. (Naval Ordnance Lab., Silver Spring, MD). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

A review of recent research on rare earth–Fe (RFe_2) compounds is presented emphasizing magnetic and magnetostrictive properties of these compounds. Discussions are included on magnetostriction of RFe_2 compounds, magnetostriction of pseudobinary Laves phase compounds, elastic energies, and amorphous RFe_2 alloys. (JRD)

11917 (CONF-741002-P2, pp 984-993) STABLE ELECTRONIC CONFIGURATION MODEL AND PROPERTIES OF RARE EARTH METALS AND THEIR COMPOUNDS. Upadhyaya, G. S. (Univ. of Roorkee, India). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

A stable electronic configuration model is presented for use in describing properties and reactions of rare earths. According to the model, during formation of condensed solid state systems, valence electrons can be divided into localized and nonlocalized groups. The localized fraction of these electrons forms a fairly broad spectrum of configurations which differ in their energetic stabilities, so that along with the very stable configurations there appear some, which are less stable or even unstable. Between the

stable configurations and the non-localized fraction of the valence electrons there occur exchanges which are responsible for the bonds between pairs of stable configurations. Discussions are included on rare earth metals, phase diagrams, alloy chemistry, and rare earth compounds. (JRD)

11918 (CONF-741002-P2, pp 1003-1013) ELECTRONIC PROPERTIES OF LIQUID RARE EARTH METALS AND THEIR ALLOYS. Busch, G.; Guentherodt, H. J.; Hauser, E.; Kuenzi, H. U.; Mueller, R. (Laboratorium fuer Festkoerperphysik der ETH, Zurich). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

New data on the electric conductivity and Hall coefficient of liquid rare earth metals are presented. Results of measurements show that the electrical resistivities of liquid rare earth metals are among the highest resistivities for liquid metals and that there exists a remarkable difference between the resistivities as a function of atomic number at low and high temperatures. In order to get more information on the electronic structure and the influence of 5d and 4f states on the transport properties further experimental investigations on liquid alloys of rare earth metals with simple and transition metals as well as alloys of rare earth metals among themselves are in progress. (auth)

11919 (CONF-741002-P2, pp 1014-1018) NMR, SOFT X-RAY, AND OTHER PHYSICAL PROPERTIES OF RARE EARTH METALS AND ALLOYS: AN ANNOTATED BIBLIOGRAPHY. Carter, G. C.; Kahan, D. J. (National Bureau of Standards, Washington, DC). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The Alloy Data Center (ADC) has deep-indexed about 18,000 papers dealing with physical properties of metals and alloys, and maintains these in a computerized file. Of these, approximately 3,000 contain information on transuranic or rare earth metals (including Sc, Y, La), or alloys with one or more such components. These literature references have been printed out alphabetically by chemical symbol to form a rare-earth annotated bibliography, which is available as the NBS Special Publication. The ADC collects all nuclear magnetic resonance (NMR) and soft x-ray spectroscopy (SXS) papers, and many papers dealing with other electronic-structure related properties as well. This bibliography, therefore, contains all NMR and SXS papers for rare-earth related metallic materials. The ADC does not intend to compete with the Rare Earth Information Center, which is far more comprehensive for many other physical properties of rare earth materials. Rather, this bibliography of the ADC's holdings is thought to represent a valuable bibliographic tool in the interim period until the Rare Earth Information Center has completed its conversion to an automated system. (auth)

11920 (CONF-741002-P2, pp 1020-1029) ATOMIC STRUCTURE AND MAGNETISM IN AMORPHOUS TERBIUM–IRON. Rhyne, J. J.; Pickart, S. J.; Alperin, H. A. (Naval Ordnance Lab., Silver Spring, MD). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Preparation and properties of amorphous Tb–Fe alloys are described. Information and data are included on neutron scattering measurements of magnetic properties, nuclear structure determination, magnetic spin correlation functions, elastic diffraction, and low angle scattering. (auth)

11921 (CONF-741002-P2, pp 1068-1076) VALENCE STATES IN LANTHANIDE SOLIDS. McCreary, J. R.; Thorn, R. J. (Argonne National Lab., IL). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

Quantitative energy values for use in statistical-thermodynamic evaluation of equations of state for nonstoichiometric solid phases in mixed lanthanide oxide phases are developed. Data and information are included on valence-states energies, and density of states in valence bands. (JRD)

11922 (CONF-741002-P2, pp 1096-1104) PHONON SPECTROSCOPY: AN EXPERIMENTAL TECHNIQUE FOR THE INVESTIGATION OF DYNAMIC MAGNETOELASTIC INTERACTIONS IN RARE EARTH METALS. Blackstead, H. A. (Univ. of Notre Dame, IN). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The application of a tuneable phonon spectrometer, developed by Anderson and Sabisky, to studies of excitations in rare earth metals circumvents many of the problems encountered by the use of conventional microwave absorption and pulse-echo techniques. Use of this system enables a direct determination of the spectral composition and intensity of phonons emitted by a sample which is driven by a combination of rf and dc magnetic fields. Films of Gd, Tb, and Dy have been investigated as well as single crystals of Gd and Dy. Experimental evidence has been obtained from studies of Gd films which indicate the existence of standing magnetoelastic waves, which are standing-wave mixed modes similar to standing spin waves. In addition, frequency doubling has been observed in films of Dy and Gd, a result of higher order magnetoelastic interactions. Measurements of the phonon signal intensity as a function of frequency in dysprosium films have been found to be in excellent agreement with calculated values, providing substantial verification of the coupled mode analysis. The phonon spectrometer, with a sensitivity of several nW of phonon power, is seen to be a powerful tool for the investigation of magnetoelastic excitations in rare earth metals. (auth)

11923 (COO-1676-34) DISLOCATION-SOLUTE ATOM INTERACTIONS IN ALLOYS. Technical Progress Report, February 1, 1974–January 31, 1975. Gibala, R.; Sethi, V. K.; Sagues, A. A. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Metallurgy and Materials Science). 31 Oct 1974. Contract AT(11-1)-1676. 22p. Dep. NTIS $4.25.

Several new results were obtained on two projects: (1) effects of solute distribution on mechanical behavior of bcc metals, and (2) mechanical behavior of hydrogenated bcc metals. Emphasis was on refractory metals and mainly on Nb. Results include: (a) observation of a strengthening effect of ~15–30% from inhomogeneous distribution of oxygen in Nb–O alloys; (b) observation of oxide film softening and hardening of high purity Nb at 77 and 300°K, respectively; (c) determination of effects of higher temperature prestrain on the strength of Nb at 77°K; (d) additional characterization of solid solution strengthening of Nb by O; (e) determination of effects of purity and oxygen content on hydrogen strengthening and embrittlement of Nb. (96 references, 6 fig) (auth)

11924 (COO-3006-1) HIGH TEMPERATURE GALVANIC-CELL INVESTIGATIONS USING SOLID ELECTROLYTES. Final Technical Report. Worrell, W. L. (Pennsylvania Univ., Philadelphia (USA). Dept. of Metallurgy and Material Science). 1 Oct 1974. Contract AT(11-1)-3006. 5p. Dep. NTIS $4.00.

The thermodynamic properties of the solid Ta–Mo, Ta–W, and Nb–Mo systems at temperatures between 1100 and 1300°K have been measured using galvanic cell techniques. These alloys are useful in many high-temperature applications, and a knowledge of their thermodynamic properties is essential at elevated temperatures. Thermodynamic activities in all three binary systems exhibit negative deviations from ideality. The negative deviations are smaller in the Ta–W system than those observed in the Ta–Mo and Nb–Mo systems. The excess integral free energy is approximately equal to the integral enthalpy of mixing. The observed small negative values for the excess integral entropy of mixing are the result of vibrational contributions and/or the presence of short range order. Overvoltage phenomena at electrode-electrolyte interface were studied. The oxygen transfer between two-phase electrodes and a zirconia-based electrolyte has been measured. The experimental two-phase electrodes are Cu–Cu_2O, Fe–FeO, and Ni–NiO. At temperatures between 1100 and 1300°K, constant and reproducible cell voltages are measured. Results indicate that the major oxygen transport across the electrode-electrolyte interface is between the electrolyte and the metal particles. (auth)

11925 (COO-3153-126) ELASTIC AND PLASTIC DEFORMATION OF SOLIDS. Annual Progress Report, February 1, 1974–January 31, 1975. Ruoff, A. L. (Cornell Univ., Ithaca, N. Y. (USA). Dept. of Materials Science and Engineering). 18 Oct 1974. Contract AT(11-1)-3153. 18p. Dep. NTIS $4.00

Results of stress-strain plastic flow measurements on K metal at liquid N_2 temperature and up to 7.0 kbars are presented. In other work, the preparation of ultrafine grained carbides was investigated along with a capacitance method of detecting phase transformations at ultrahigh pressure, equations of state, stress concentrations in solids, and effects of Mg^{2+} doping on creep of LiF. (JRD)

11926 (COO-3395-9) RETENTION OF METASTABLE γ-Np AND ϵ-Pu ALLOYS AND STUDIES RELATIVE TO THEIR POSSIBLE SUPERCONDUCTIVITY AT LOW TEMPERATURES. Hill, H. H.; Elliott, R. O.; Giessen, B. C. (Northeastern Univ., Boston, Mass. (USA)). Aug 1974. 5p. (CONF-741057-2). Dep. NTIS $4.00.

From international symposium on the electronic structure of the actinides; Argonne, Illinois, USA (9 Oct 1974).

Metastable bcc γ-Np and ε-Pu solid solution alloys were retained to room temperature by rapid quenching from the liquid state. Ga additions were employed to stabilize γ-Np, Ti used to retain ε-Pu. To estimate possible superconducting transition temperatures for these phases of Np and Pu, Np and Pu were substituted for U in γ-U alloys ($T_c \approx 2K$). $\ln T_c$ was found to decrease linearly with Np or Pu additions, up to concentrations of 30 and 15 at. %, respectively. Extrapolations to 100 at. % "impurity" concentrations indicated probable T_c values of ~30 mK for γ-Np and ~2 mK for ε-Pu. The γ-Np(Ga) and ε-Pu(Ti) alloys were not superconducting above 0.5 K, as expected. Studies to lower temperatures are in preparation. (auth)

11927 (HEDL-TME-71-53(Vol. 1)) MATERIAL CONSIDERATIONS IN SUPPORT OF THE FFTF. Preliminary Safety Analysis Report-RM 9. Volume I. Claudson, T. T. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). 9 Apr 1971. Contract AT(45-1)-2170. 340p. AT.

Research activities are summarized on mechanical properties of 304 and 316 stainless steels, mechanical properties of welded joints, in-reactor creep in refractory alloys, radioinduced swelling of stainless steels, and sodium effects on reactor materials. (JRD)

11928 (HEDL-TME-71-53(Vol. 2)) MATERIAL CONSIDERATIONS IN SUPPORT OF THE FFTF. Preliminary Safety Analysis Report-RM 9. Volume II. Claudson, T. T. (comp.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). 9 Apr 1971. Contract AT(45-1)-2170. 152p. AT.

Results of a program to estimate whether or not cracks in FFTF piping will leak a detectable amount of Na before these cracks become critical are presented. Discussions are included on prediction of fatigue-crack growth in structural components, notch tensile and stress rupture properties of FFTF structures, effects of prior creep deformation on residual tensile properties of austenitic stainless steels, and effects of strain rate on mechanical properties of austenitic stainless steel. Data are included on test specimens and test results. (JRD)

11929 (IS-3346(Pt.3)) COMPILATION OF EXPERIMENTAL WORK ON THERMAL EMITTANCES OF MATERIALS. Part III. Alloys. Baria, D. N.; Bautista, R. G. (Ames Lab., Iowa (USA)). Nov 1974. Contract W-7405-eng-82. 204p. Dep. NTIS $7.60.

A compilation of the experimental work on thermal emittances of alloys reported in the literature through 1972 are presented along with a brief review of the various experimental methods available for thermal emittance determinations. (auth)

11930 (JUL-1083-FF) DIFFUSION REACTIONS OF POINT DEFECTS. Schroeder, K. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Jul 1974. 211p. Dep. NTIS (U. S. Sales Only) $13.75.

Diffusion controlled reactions between point defects is treated considering the discreteness of diffusion due to lattice structure and realistic long range interaction potentials between mobile defects and sinks. It turns out that the reactions are adequately described by continuum diffusion representing the sinks by phenomenological spherical interaction volumes. The radii of these volumes are determined by the microscopic structure of the sinks as well as by the interaction potential. Due to the interaction the radii are temperature dependent, e.g., for strong attractive potentials V(R) or low temperature the effective interaction radius R_a is approximately given by $-V(R_a) = kT$; i.e., by the distance from the sink at which the potential energy gained due to the interaction equals the thermal energy. (auth)

11931 (LA-5721-MS) IMPURITY EFFECTS ON LOW-TEMPERATURE PHYSICAL PROPERTIES OF URANIUM. Sandenaw, T. A. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 17p. Dep. NTIS $4.00.

Dips in low temperature heat capacity results for nominal high-purity uranium can be attributed to heat evolution from the U which is acting like a quenched martensite. Because of its martensite-like properties, the cooling rate through the $\beta \rightarrow \alpha$-phase transformation can affect the low-temperature physical properties of α-phase U. Published information suggests that there will be no structural modification in very pure U below room temperature. A single change, thought to be structural, is observed at 36°K in U of nominal high purity. It is ascribed to Fermi surface-Brillouin zone boundary interactions. Phenomena observed at 250 and 338°K are seemingly associated with the 36°K structural modification. The appearance of as many as three low temperature heat capacity transitions, for low-purity U, is attributed to impurity content. The observation of three low temperature transitions in single-crystal U, as reported in the literature, may be due to the grain-coarsening method of preparation of single crystals through Si addition. Heat capacity results presented here are considered to be a function of the impurity content and microstructure of a particular U specimen at the time of C_p measurement. (auth)

11932 (LBL-2265) STUDY OF ELECTRON CURRENT INTENSITIES EMITTED FROM THE SUPERLATTICE PLANES OF AN ORDERED ALLOY. Lira-Olivares, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). May 1974. Contract W-7405-eng-48. 235p. Dep. NTIS $14.75.

Thesis.

The electron emission from cold, Ni_4W specimens was studied using a field ion-field emission microscope and a Jarrell–Ash recording microphotometer. Small current variations were observed on azimuthal intensity measurements on the α phase. These were interpreted as produced by different densities of solute (W) at the surface of the emitter. The electron current emitted from the layered superlattice planes of the β phase, showed cyclical changes in intensity produced by the removal of atomic monolayers using field evaporation. Such a variation was interpreted by comparing the field evaporation process of the layered superlattice planes with the adsorption of epitaxial layers on a metal substrate. The Topping dipolar model was applied for numerical interpretation of the data and was found inconsistent with the experimental results. A simple model was suggested for the interpretation of the current variation observed. The model might have applicability to the understanding of some adsorption phenomena. The observation of the elusive γ phase of Ni_4W using field ion-field emission microscopy is also reported in this work, as well as a variation of the standard field ion microscopy method for the observation of surface defects. (auth)

11933 (LBL-2772) INVESTIGATION OF BAINITE TRANSFORMATION IN MEDIUM CARBON LOW ALLOY STEELS. Babu, B. N. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 151p. Dep. NTIS $10.75.

Thesis.

The effects of small additions of common alloying elements (C, Ni, Cr, Mn, Mo and Si) on the kinetics of the bainite reaction in 4340 steel were studied, using a rapid magnetic permeability method and an automatic continuous recording to follow the austenite decomposition. Computer aided methods were used to analyze the isothermal reaction data and to plot the time-temperature-transformation diagrams. An acceleration of the bainite reaction just above the M_s temperature gave an S-shaped curve for the bainite reaction in all the steels studied. In some of the steels, separate C-curves for the upper and lower bainite were observed in the initial stages of transformation, but these overlapped in the latter stages. All the alloy additions (wt%) except Mo increased the incubation times for bainite reaction. Si up to 2% was as effective as Ni or Cr, and 1% Ni + 1% Cr was more effective than either 2% Ni or 2% Cr in increasing the incubation period. All the alloying elements except Mo shifted the bainite curves to longer times and lowered the kinetic B_s and B_f temperatures. Mo, when added alone, accelerated the bainite reaction and raised the B_s and M_s temperatures, but when added together with Ni or Cr, retarded the bainite reaction. Mn, up to 2% was more effective than Ni or Cr in improving the bainite hardenability. Effect of a 2% alloy addition was not equal to 2 times the effect of 1% addition; ratios of times for 5% transformation for 2% vs 1% additions of Ni, Cr, and Mn are 1.3, 15.5, and 20 respectively. Effect of combined additions on bainite hardenability was not linear, but mixed additions had an additive effect in lowering B_s. An equation was derived to calculate B_s directly from the composition. In 4340 and 4340 modified with Ni, Cr, Mn, and Mo, the experimental activation energy of decomposition changed around 350°C, indicating that the initial transformation product may change from upper bainite to lower bainite or vice versa at about 350°C. Transmission electron microscopy studies of the morphology of bainite in 4340 + 0.1% C steel showed that mixed bainites formed in the temperature range where the two C-curves of upper bainite and lower bainite overlap. Thus, depending on the transformation temperature, upper bainite may form first followed by lower bainite or vice versa. The classical forms of bainite containing carbides were formed in 4340 + 0.1% C steel. G. Lai has shown the upper bainite that formed in Si-modified steels was devoid of carbides. Partial transformation to bainite produced significant amounts of retained austenite in all the steels studied, with Si-modified steels showing considerably larger amounts of retained austenite. For the same C content, the amount of retained austenite obtained at any particular reaction temperature increased with the increase in Si content and for the same Si content, it increased with increasing C content. (37 figures, 63 references) (DLC)

11934 (LBL-2936) HYPERFINE INTERACTIONS AND ESCA DATA. Shirley, D. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-eng-48. 22p. (CONF-740633-3). Dep. NTIS $4.25.

From international conference on hyperfine interactions studied in nuclear reactions and decay; Uppsala, Sweden (10 Jun 1974).

Comparison is made of those data obtained from ESCA and from hyperfine interactions that bear on the same problems. A formal Hamiltonian can be written in which ESCA shifts and structure are discussed as E0, M1, E2, ... terms. Under the E0 term core-level shifts are compared with isomer shifts and diamagnetic shifts. The M1 term refers to exchange splitting (core polarization). Multiplet splitting can identify local moments with fluctuation times down to 10^{-15} s. Rare earths and the 3d group are considered. The E2 term yields a crystal-field energy transforming as Y_2^0 and correlated with e^2qQ in metals. Finally the valence-band density of states in noble metals can be related to a Y_4 term if nearest neighbors in metals are effectively negative; i.e., conduction electrons, rather than ion cores, are dominant. (6 figures, 20 references) (auth)

11935 (LBL-3121) KINETICS OF AUTO-TEMPERING IN SELECTED PLAIN CARBON AND ALLOY STEELS. Zajchowski, P. H. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 56p. Dep. NTIS $6.00.

Thesis.

The kinetics of auto-tempering were studied in five steels—AISI 1090, AISI 1046, AISI 4340, AMS 6416 (300-M), and modified 4340 + 3% Si at six tempering temperatures, 100, 150, 180, 240, 270, and 300°C by an electrical resistance method. With increasing isothermal tempering temperatures (100 to 300°C) the effects of the alloying elements, upon the tempering rate, became progressively greater. Silicon was observed to retard the tempering rate with increasing tempering time at a fixed temperature. Also, the ductility of steels tempered at 180°C was found to increase with tempering time and to decrease with increasing silicon content. (auth)

11936 (LBL-3177) CALORIMETRIC STUDIES OF SINGLET-GROUND-STATE SYSTEMS. Wun, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 55p. Dep. NTIS $5.75.

Thesis.

Terbium ethyl sulfate and $PrCu_2$ are examples of compounds in which the rare earth ions are in singlet crystal field ground states and the exchange coupling between ions is smaller than the critical value required for magnetic moment formation. Heat capacity measurements on $PrCu_2$ suggest that the singlet ground state arises from a Jahn–Teller distortion and give a value for the hyperfine enhancement of magnetic field at the nucleus. In terbium ethyl sulfate a cooperative transition to an ordered state is observed at 0.25°K. This transition probably arises from a combination of dipole–dipole and hyperfine interactions. (auth)

11937 (PEL-232) THERMODYNAMIC PROPERTIES AND PHASE DIAGRAM OF TERNARY SODIUM ALLOYS. II. The System Sodium + Lead + Indium. Neethling, A. J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Apr 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

Emf measurements at 670 to 760°K were used to determine the thermodynamic properties of the Na component. Corresponding functions for the Pb and In components were calculated with Darken's method. Integral properties for the system are also tabulated. Thermal analysis was used to determine the solid–liquid equilibrium surface for the ternary system. (7 tables) (auth)

11938 (SAND-74-5169) CORRELATION BETWEEN EXPLOSION TIMES AND INITIAL MOLAR CONTENT FOR METAL DROPLETS BURNING IN AIR. Nelson, L. S.; Freese, J. M.; Richardson, N. L. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 18p. (CONF-741049-2). Dep. NTIS $4.00.

From meeting of the Western States Section/The Combustion Institute; Northridge, California, USA (21 Oct 1974).

The free-fall combustion of submillimeter-diameter droplets of eleven transition and rare earth metals in dry air was studied by a laser ignition technique. Each metal burned in a similar, coherent manner and exploded after a reproducible combustion time. For a given droplet diameter, a linear correlation between the time to explode and the number of moles of metal present in the droplet upon ignition was discovered. If the analogy may be drawn with earlier work on Zr droplet combustion, the apparent oxygen transfer rate is constant from metal to metal. Since it is unlikely that all eleven metals have identical intrinsic oxygen uptake rates, the oxygen supply must be limited by diffusion through the boundary layer which surrounds the droplets for the combustion conditions studied here. These experiments place a lower limit on the intrinsic oxygen uptake rates of the eleven molten metals during high temperature oxidation. (31 references) (auth)

11939 (SAND-74-8218) HYDROGEN EMBRITTLEMENT AND THE IRON TITANIUM HYDRIDE ENERGY STORAGE SYSTEM. Keeton, S. C. (Sandia Labs., Livermore, Calif. (USA)). Nov 1974. Contract AT(29-1)-789. 21p. Dep. NTIS $4.25.

A comprehensive study of potential hydrogen embrittlement problems in the Brookhaven iron titanium hydride energy storage system is given. Hydrogen pressure and temperature cycling, oxide reduction by FeTi, bubble and blister formation and slow crack growth are considered. The conclusions reached are that AISI 316 stainless steel can be used as the pressure vessel material, but it represents an "over-qualified" material for this purpose. Most other 300-series stainless steels would be acceptable. However, some plain carbon steels might be adequate and would offer less expensive alternatives. (auth)

11940 (UCLA-34P201X2) FOURIER-SPACE COMPUTER SIMULATION OF CRYSTALLINE IMPERFECTIONS. III. Third Annual Progress Report, January 1, 1974–December 31, 1974. de Fontaine, D. (University of Southern California, Los Angeles (USA)). Oct 1974. Contract AT(04-3)-34. 32p. (UCLA-ENG-7475). Dep. NTIS $4.75.

The Fourier transform method, used to describe defect or solute atom configurations in terms of concentration waves, is the basis for computer programs for calculating elastic interaction energies and atomic displacements of defect structures. Results were obtained for interaction energy calculations of defect clusters in the continuum limit. The existence of stable cluster configurations is demonstrated. The wave concept is particularly useful in kinetic studies. The mechanism of spinodal ordering is introduced to account for kinetics of partial ordering in the Ni–Mo system. Short-range order dynamics are also studied by this method supplemented by group-theoretic symmetry considerations. Symmetry rules in Fourier space are further used to classify phase transformation and mechanisms. Time-dependent perturbation theory, which is at the root of spinodal theory, is used to study possible oscillatory behavior of vacancy concentrations in irradiated materials. The origin of the void lattice is concluded, on the basis of the afore-mentioned elasticity calculations, to be due to a coarsening reaction biased by direction-dependent attractive and repulsive vacancy-cluster interaction energies. (auth)

11941 (UCRL-75757(Rev.1)) TRITIUM DEPTH PROFILING BY NEUTRON TIME-OF-FLIGHT. Davis, J. C.; Anderson, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Aug 1974. 16p. (CONF-741015-8). Dep. NTIS $4.00.

From 21st national symposium of the American Vacuum Society; Anaheim, California, USA (7 Oct 1974).

A method has been developed to measure the depth profile of tritium implanted or absorbed in materials. The sample is bombarded with a pulsed proton beam. Neutron energies from T(p,n) reactions occurring in the target are measured by time-of-flight over a 10.8 m flight path. From the neutron energy the proton energy and thus the tritium depth in the target may be inferred. The measurements were initiated to determine the depletion of tritium absorbed in titanium layers. These layers had served as targets on a 400 keV T(d,n) neutron generator. A depth resolution of 0.4 mg/cm^2 of titanium (0.9 μm) was obtained. Unlike proton backscattering methods, the technique can be used with thick samples. It is estimated that a sensitivity of 0.1 at.% tritium in host materials can be obtained. Extension of the method to deuterium depth profiling is possible with the use of the D(d,n) reaction. (auth)

11942 (WARD-AD-3045-1) BASIS FOR Fe–Cr–Ni EXPERIMENTAL ALLOY DEVELOPMENT PROGRAM FOR LMFBR. Bleiberg, M. L.; Rowcliffe, A. F. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). 30 Jun 1974. Contract AT(11-1)-3045. 40p. AT.

A rationale for experimental alloy compositions in the Fe–Cr–Ni system has been developed as part of the alloy development program for LMFBR ducts and cladding. A review was made of the parameters and mechanisms which have been experimentally demonstrated or theoretically predicted to influence swelling. Although the experimental data are minimal and the current theories inadequate, a basis for the alloy compositions was developed. The selected compositions will provide basic information on the influence of composition, minor elements, substitutional solute additions, and precipitates on swelling and irradiation creep in Fe–Cr–Ni alloys. Also, they will assist in understanding the irradiation behavior of commercial alloys. These alloys have potential for development as suitable alloys, not only in regard to swelling, but also for optimum mechanical properties and sodium compatibility. Although there are a large number of variables

which can influence in-reactor alloy behavior, inherent in the selection of the compositions are statistical design concepts which are shown to provide a high level of confidence in evaluating the test results. (auth)

11943 (WARD-NA-3045-16) SODIUM TECHNOLOGY PROGRAM. Friction, Wear, and Self-Welding Quarterly Progress Report for Period Ending July 31, 1974. Ray, W. E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1974. Contract AT(11-1)-3045. 84p. AT.

Research and development progress is reported on properties of materials for use in sodium systems. Results of work on friction and wear, materials self-welding, evaluation of duct load pad materials, and evaluation of wear resistant surfaces are summarized. (JRD)

11944 SIMPLE MODEL FOR THE EFFECT OF PRESSURE ON THE PROPERTIES OF NARROW BAND METALLIC PARAMAGNETS. Bahurmuz, A. A.; Zuckermann, M. J. (McGill Univ., Montreal). Solid State Commun.; 15: No. 7, 1225-1227(1 Oct 1974).

It is shown that the effect of pressure on the resistivity of $\alpha-Ce$ can be qualitatively explained by a simple band model for spin fluctuations in narrow band metallic paramagnets. (auth)

11945 MAGNETIC PROPERTIES OF THE INTERMETALLIC COMPOUND PrAg. Brun, T. O. (Argonne National Lab., IL); Kouvel, J. S.; Lander, G. H.; Aitken, R. Solid State Commun.; 15: No. 7, 1157-1159(1 Oct 1974).

The field and temperature dependences of the magnetization of PrAg are found to be those of an antiferromagnet whose Néel point is ~ 11°K and which undergoes a spin-flop transition at a critical field of ~ 5 kOe, as confirmed by high-field neutron diffraction measurements. Preliminary comparisons are made with properties calculated from crystal-field theory. (auth)

11946 MAGNETIZATION, MAGNETOCRYSTALLINE ANISOTROPY AND THE CRYSTALLINE ELECTRIC FIELD IN (RARE EARTH) Al_2 COMPOUNDS. Purwins, H. G. (Univ., Geneva); Walker, E.; Barbara, B.; Rossingnol, M. F.; Bak, P. J. Phys., C (London); 7: No. 19, 3573-3582(7 Oct 1974).

Magnetization measurements are reported for single crystals of $PrAl_2$ in the range from 4.2 to 30 K for magnetic fields up to 150 kOe applied in the ⟨100⟩, ⟨110⟩, and ⟨111⟩ directions. For these measurements, together with the magnetization results obtained earlier for $TbAl_2$, a quantitative quantum mechanical description of the magnetization is given and the related magnetocrystalline anisotropy in terms of a cubic crystalline electric field and an isotropic exchange interaction. The parameters used in this description can be unified to good approximation to all (rare earth) Al_2 intermetallic compounds where detailed experiments are available. (auth)

11947 CRYSTAL STRUCTURE OF I-TETRAGONAL BORON. Will, G.; Ploog, K. (Univ., Bonn). Nature (London); 251: No. 5474, 406-408(4 Oct 1974).

The crystal structure of the substance known as "I-tetragonal boron" is discussed. This was first prepared in crystalline form in 1943 (J. Amer. Chem. Soc. 65: 1924 (1943)) and believed to be a polymorph of elementary boron. Evidence has been accumulated, however, showing that this is not true, and that the substance is a non-metal boride, having unit cell parameters a = 8.75Å, c = 5.06Å, Z = 50. It is shown that quantum mechanical considerations, using the concept of closed shell type B icosahedra, explain why elementary B cannot be prepared in the I-tetragonal form. Methods were developed, however, for producing the lattice of the I-tetragonal form, using pyrolysis of BBr_3-CH_4-H_2 mixtures on Ta substrates, to yield B carbide of composition $B_{25}C$, and BBr_3-N_2-H_2 mixtures on BN substrates to yield $B_{25}N$. Precise electron density determinations were also made. The unit cells contain 50 B atoms and 2 C or N atoms. Details are given of the crystal structure. The quantum mechanically unstable B_{48} lattice is stabilized by B and C or N atoms to yield the compositions $B_{48}B_2C_2$ or $B_{48}B_2N_2$. (UK)

11948 NEW GRADE ELIMINATES HEAT TREATMENT. Metal Progr.; 106: No. 7, 90-91(Dec 1974).

A new P/M steel (IN-861), of composition Fe-2Ni-0.7Mn-1Mo, does not require a quench and temper treatment to develop high mechanical properties; it hardens during normal cool-down in most sintering furnaces. As-sintered mechanical properties (tensile, yield, transverse rupture, hardness, Charpy impact) are plotted vs density and temperature. (6 fig) (DLC)

11949 HIGH-TEMPERATURE PROPERTIES OF SODIUM FOR SAFETY STUDIES OF LIQUID-METAL FAST BREEDER REACTORS. Padilla, A. Jr. (Argonne National Lab., IL). Nucl. Sci. Eng.; 55: No. 4, 452-461(Dec 1974).

A set of high-temperature thermodynamic properties for sodium in the two-phase and subcooled-liquid regions has been predicted for the region between the low-temperature properties recommended by Golden and Tokar and the critical temperature. This set is recommended for consistent thermodynamic calculations in reactor safety analyses involving sodium. The saturation properties determined are: vapor pressure, liquid and vapor density, liquid and vapor enthalpy, liquid and vapor entropy, liquid compressibility (adiabatic and isothermal), liquid thermal-expansion coefficient, and liquid specific heat (constant pressure and constant volume). The subcooled-liquid properties determined are: pressure, enthalpy, entropy, compressibility (adiabatic and isothermal), thermal-expansion coefficient, and specific heat (constant pressure and constant volume). (14 fig) (auth)

11950 COMPOSITIONAL CHANGES ASSOCIATED WITH PERIODIC ANTIPHASE BOUNDARIES IN THE INITIAL STAGES OF ORDERING IN Ni_3Mo. II. Elemental Analysis. van Tendeloo, G. (Rijksuniversitair Centrum, Antwerp); Delavignette, P.; van Landuyt, J.; Amelinckx, S. Phys. Status Solidi (a); 26: No. 1, 299-304(16 Nov 1974).

Energy dispersive analysis of x rays as an accessory to a transmission electron microscope were used to investigate local compositional changes associated with the presence of periodic nonconservative antiphase boundaries in the initial stages of ordering in Ni_3Mo. It is shown how a relative quantitative elemental analysis of the local alloy composition can be performed to a precision of better than 5%. A detailed analysis is described for 13.9 Å spaced periodic antiphase boundaries in Ni_3Mo where a local excess in Ni could be determined, leading to a composition of $Ni_{3.4}Mo$. Measurements confirm the proposed structural model. (auth)

11951 VANADIUM DENDRITIC SEGREGATION IN CARBON STEEL. Malinochka, Ya. N.; Olikhova, M. A.; Savich, A. I.; Bosis, Z. M.; Moiseev, B. P. Stal; No. 5, 453-455(May 1973). (In Russian).

Using a microprobe, the dendritic segregation of vanadium in a 3.5-ton ingot of carbon steel containing 0.4 to 0.6% C and its effect on the microstructure were studied. In the center of the steel ingot with 0.58%C and 0.150% V, the V concentration in the axial parts was 0.04 to 0.07% and in the intermediate parts, 1.3 to 1.4%. The degree of segregation in the steel with 0.44% C was somewhat less. In parts enriched in V, structurally free ferrite and slightly dispersed inclusions of vanadium carbide were formed. In parts with the highest enrichment, carbide nets and places where there was a carbide eutectic, A + VC were observed. These special features may indicate the strength properties of the steel containing vanadium and its plasticity. (tr-auth)

11952 PRECIPITATES AND FLUX-PINNING ASSOCIATED WITH HIGH-FIELD SUPERCONDUCTORS CONSISTING OF NIOBIUM-TITANIUM. Hillmann, H. (Vacuumschmelze GmbH, Hanau, Ger.). Siemens Forsch.-Entwicklungsber.; 3: No. 4, 197-204(1974). (In German).

An investigation was conducted on the optimization of superconducting NiTi filaments with alpha-Ti precipitates. Critical current density maxima were determined as a function of the degree of cold work and the magnetic induction. Displacement effects of cold work on the volume-related pinning force were studied along with the relation between the relative pinning force maxima and the external magnetic field. The characteristics of the critical current density are considered in a model. The relative maxima are accounted for on the basis of a correspondence between the distribution of the precipitates and the flux line pattern. (IAA)

11953 MAGNETIC AND STRUCTURAL PROPERTIES OF THE RARE EARTH ALLOYS WITH IRON, COBALT, AND NICKEL. Burzo, E. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 4, 425-445(1973). (In Rumanian).

The sections are: introduction; phase diagrams and crystalline structures; preparation of the alloys; magnetic behavior; and conclusions. (21 fig, 38 references) (DLC)

11954 GORSKY EFFECT MEASUREMENTS OF HYDROGEN DIFFUSION IN NIOBIUM. Matusiewicz, G.; Booker, R.; Keiser, J.; Birnbaum, H. K. (Univ. of Illinois, Urbana). Scr. Met.; 8: No. 12, 1419-1426(Dec 1974).

The Gorsky effect is an anelastic technique in which an applied elastic strain gradient results in a flux of H across the specimen; this flux manifests itself in a stress or strain relaxation. It was undertaken to examine the effects of hydride precipitation on measured D values, the correspondence between static (strain relaxation) and dynamic (internal friction) Gorsky effect measurements, and the effect of O and dislocation trapping sites on long-range diffusivities. Dynamic and static measurements were found to

agree. Deviation from the Arrhenius relation was not observed down to 165°K in the absence of hydride precipitation. The activation enthalpy was increased by O and dislocation trapping and hydride precipitation. (DLC)

11955 MICROSTRUCTURE AND PHASE STABILITY OF INCONEL ALLOY 617. Mankins, W. L.; Hosier, J. C.; Bassford, T. H. (International Nickel Co., Inc., Huntington, WV). Met. Trans.; 5: No. 12, 2579-2590(Dec 1974).

A laboratory study was performed to determine the effects of long-time (215 to over 10,000 h) exposure to temperatures up to 2000°F on the microstructure and phase stability of Inconel 617. To investigate the strengthening response during high-temperature exposure, microstructures were correlated with mechanical properties. The major phase present in the alloy after exposure to all temperatures from 1200 to 2000°F was found to be $M_{23}C_6$. The phase precipitated as discrete particles and remained stable at all temperatures. No MC or M_6C carbides were found. A small amount of gamma prime was found in samples exposed at 1200 and 1400°F. A PHACOMP analysis indicated 0.63% gamma prime could form. No topological close-packed phases such as sigma, mu, and chi were found. Strengthening of the alloy during exposure to temperature was found to result primarily from the precipitation of $M_{23}C_6$. The phase provides effective strengthening because it precipitates in discrete particles and remains stable at temperatures to 2000°F. The amount of gamma prime formed is not sufficient to cause appreciable hardening, but it does provide some strengthening at 1200 to 1400°F. (auth)

11956 VOLUME CHANGE ACCOMPANYING SOLIDIFICATION. Wray, P. J. (U. S. Steel Corp., Monroeville, PA). Met. Trans.; 5: No. 12, 2602-2603(Dec 1974).

Estimates are given for the relative volume change on freezing, for various metals (including Cd and In) and a portion of the Fe–C alloy system. Effects of C content (0 to 1.5 wt %) on the volume change of Fe–C are considered in detail. (DLC)

11957 INFLUENCE OF ALLOYING ELEMENTS UPON THE MORPHOLOGY OF AUSTENITE FORMED FROM MARTENSITE IN Fe–C–X ALLOYS. Plichta, M. R.; Aaronson, H. I. (Michigan Technological Univ., Houghton). Met. Trans.; 5: No. 12, 2611-2613 (Dec 1974).

Fe alloys containing 0.11 to 29% C and either 1.83% Si, 3.08% Mn, 3.29% Ni, 0.99% Co, 0.39% Mo, 2.03% Al, 2.99% Cr, or 2.98% Cu were homogenized, austenitized, quenched to form martensite, and finally quenched again. The observations on the effect of the alloying additions upon austenite morphology were used to classify the alloys into three groups, on the basis of late reaction time microstructures. (DLC)

11958 PHASES EQUILIBRIA IN THE Zr–Fe–Ga AND Zr–Co–Ga SYSTEMS. Markiv, V. Ya.; Storozhenko, A. I. (Kiev State Univ.). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 10, 945-949(Oct 1974). (In Ukrainian).

The Zr–Fe–Ga and Zr–Co–Ga systems were investigated by means of x-ray diffraction and microscopic analyses. Phase equilibria were determined at 800°C, and the existence of six (Zr–Fe–Ga) and fourteen (Zr–Co–Ga system) ternary phases was established. (auth)

11959 SURFACE DIFFUSION OF ATOM CLUSTERS. Graham, W. R.; Ehrlich, G. (Illinois Univ., Urbana). J. Phys., F (London); 4: No. 10, L212-L214(Oct 1974).

Quantitative measurements were made of the motion of tungsten doublets and triplets on the (211) plane of tungsten. It is shown that these clusters diffuse by the movement of one atom at a time. The activation energy (35 kJ mol^{-1}) and prefactor (10^{-11} cm^2s^{-1}) of the diffusion coefficient are the same for both doublets and triplets, but differ substantially from the parameters characteristic of single-atom motion. This behavior is interpreted in terms of strong attractive interactions between pairs of atoms. (auth)

11960 PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Referate Zeitschrift. Band 8, Heft 1-6. Halbjahresregister 1974. (Plutonium-Documentation. Transplutonium Elements. Abstract Journal. Vol. 8, No. 1-6, 1974. Semi-Annual Index). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H. (1974). 140p. (In German and English).

The document contains the 1974 first semiannual index for the abstract journal-bibliography Plutonium-Documentation Transplutonium-Elements. (SFL)

11961 PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Zeitschrift. August 1974. Band 8, Heft 8. 199 Referate (Register-Nr. 2583-2963); 68 Referate (Register-Nr. 567T-634T). (Plutonium-Documentation. Transplutonium Elements. Abstract Journal. August 1974. Vol. 8, No. 8. 199 Abstracts (Register No. 2583-2963); 68 Abstracts (Register No. 567T-634T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1974). 124p. (In German and English).

Abstracts or citations are given for 486 publications on plutonium and transplutonium elements in the fields of metallurgy, nuclear physics, reactor physics, chemistry, biology, and medicine. (SFL)

11962 PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Referate-Zeitschrift. September 1974. Band 8, Heft 9. 251 Referate (Register-Nr. 2964-3418); 104 Referate (Register-Nr. 635T-738T). (Plutonium-Documentation. Transplutonium Elements. Abstract Journal. September 1974. Vol. 8, No. 9. 251 Abstracts (Register No. 2964-3418); 104 Abstracts (Register No. 635T-738T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung m.b.H (1974). 166p. (In German and English).

Abstracts or citations are given for 608 publications on plutonium and transplutonium elements in the fields of metallurgy, nuclear physics, reactor physics, chemistry, biology, and medicine. (SFL)

11963 PLUTONIUM-DOKUMENTATION. Transplutonium-Elemente. Referate-Zeitschrift. Oktober 1974. Band 8, Heft 10. 182 Referate (Register-Nr. 3419-3775); 82 Referate (Register-Nr. 739T-820T). (Plutonium-Documentation. Transplutonium-Elements. Abstract Journal. October 1974. Vol. 8, No. 10. 182 Abstracts (Register No. 3419-3775); 82 Abstracts (Register No. 739T-820T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschungslange m.b.H. (1974). 124p. (In German and English).

Abstracts or citations are given for 483 publications on plutonium and transplutonium elements in the fields of metallurgy, nuclear physics, reactor physics, chemistry, biology, and medicine. (SFL)

11964 EFFECTS OF ANISOTROPIC EXCHANGE AND MAGNETOELASTIC COUPLING ON MAGNETIC PHASE TRANSITIONS IN HOLMIUM AND ERBIUM. Southern, B. W.; Sherrington, D. (McMaster Univ., Hamilton, Ontario). J. Phys., F (London); 4: No. 10, 1755-1768(Oct 1974).

The effects of both anisotropic exchange and magnetoelastic coupling on phase transitions involving flat, conical and tilted spiral phases are investigated. Also the conditions under which the magnon modes in conical and flat spiral phases may soften are examined when anisotropic exchange is taken into account. It is found that both anisotropic exchange and magnetoelastic coupling can inhibit the instability of the magnon mode with q = Q in the flat spiral phase, but that the nature of the transition which occurs is quite different in each case. These results are discussed with reference to the phase transitions which occur in holmium and erbium near 20K. (auth)

11965 SPECIFIC HEAT OF HIGH PURITY GADOLINIUM BETWEEN 1.5 AND 14 K. Wells, P.; Lanchester, P. C.; Jones, D. W.; Jordan, R. G. (Southhampton Univ., Eng.). J. Phys., F (London); 4: No. 10, 1729-1735(Oct 1974).

The specific heat of high purity gadolinium, prepared by solid state electrotransport processing was measured in the temperature range 1.5 to 14 K, and the data analyzed for electronic, Debye, and magnetic contributions to the total specific heat. The electronic coefficient was found to be 3.7 ± 0.2 mJ mol^{-1} K^{-2} and the magnetic specific heat, assumed to be of the form $C_M = BT^n$, yielded B = 1.94 ± 0.04 mJ mol^{-1} $K^{-(n+1)}$ with n = 1.75 ± 0.05. The Debye temperature between 1.5 and 5 K was calculated to be 187 ± 3 K, while for temperatures in excess of 5 K it was found to decrease with temperature to a constant value of 160 ± 3 K above 12 K. (auth)

11966 THERMODYNAMIC CALCULATIONS FOR LIQUID ALLOYS WITH AN APPLICATION TO SODIUM-POTASSIUM. Umar, I. H.; Meyer, A.; Watabe, M.; Young, W. H. (East Anglia Univ., Eng.). J. Phys., F (London); 4: No. 10, 1691-1706(Oct 1974).

A formalism is presented for calculation, in liquid alloys, of the partial structure factors, the free energies and associated thermodynamic properties. An application is made to NaK alloys with encouraging results. (auth)

11967 STUDY OF THE ELECTRIC QUADRUPOLE INTERACTION AT Ta IMPURITIES IN RARE EARTH METAL HOSTS. Forker, M.; Fechner, J. B.; Haverkamp, H. (Bonn Univ. (F.R. Germany). Inst. fuer Strahlen- und Kernphysik). Z. Phys.; 269: No. 3, 279-284(1974).

2 figs.; 1 tab.; 27 refs.

The time differential perturbed angular correlation technique has been used to measure the electric field gradient (EFG) at the site of ^{181}Ta impurities in the heavy rare earth metals Gd,

Tb, Dy, Ho and Er at room temperature. It is found that the ratio between the measured EFG and the lattice EFG which is known from lattice sum calculations is in the order of α approximately equal to 300, suggesting that an important contribution to the EFG is due to electrons localized at the impurity. The ratio α is not constant throughout the Rare Earth series. It decreases from Gd to Tb and increases between Tb and Er. This behavior is compared to the results of a previous investigation with the impurity Cd in the same hosts. (auth)

11968 THIRD-ORDER ELASTIC CONSTANTS, PRESSURE DERIVATIVES OF THE SECOND-ORDER ELASTIC CONSTANTS AND ANDERSON-GRUENEISEN PARAMETER DELTA OF RHENIUM. Ramji Rao, R. (Univ., Geneva). Lett. Nuovo Cim.; 11: No. 13, 603-605(30 Nov 1974).

Third-order elastic constants are evaluated for Re which have nearly the ideal axial ratio value on the basis of a nearest-neighbor central interaction model. These constants are then used to evaluate the pressure derivatives of the second-order constants and the Anderson-Grueneisen parameter. Values are tabulated for both the thermal $\bar{\gamma}_H = 2.39$ and the elastic $\bar{\gamma}_H = 1.83$. (auth)

11969 CALCULATION OF RARE EARTH-CALCIUM ALLOY PROPERTIES. Bayanov, A. P. (Kuban State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 128-132(1974). (In Russian).

Equations are presented and calculated values are tabulated for thermodynamic properties of La-Ca, Ce-Ca, Nd-Ca, Y-Ca, Ca-Eu, and Ca-Yb. Among the results was the observation that Ca reacts with Eu more readily than with La. The reactions of Ca with divalent Eu and Yb are more energetic than with the trivalent rare earths. Eu and Yb are divalent in alloys with Ca. (MG)

11970 DISINTEGRATION OF ANOMALOUSLY SUPERSATURATED SOLID SOLUTIONS IN Al-Cr-Zr ALLOY GRANULES. Berman, S. I.; Imanov, Kh. I.; Kasumzade, N. G. (Moscow Inst. of Steel and Alloys). Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 5, 141-144(1974). (In Russian).

Plastic deformation of Al alloy granules increased the disintegration rate of anomalously supersaturated solid solutions of Al-1.5% Cr-1.5% Zr. The maximum temperature of strengthening of cold-deformed granules was 50°C below that of poured, which must be considered in developing a process for making semifabricates, pressure treated, from granular Al alloys. In the initial stages of the solid solution disintegration, uniaxial nuclei of the new phases form, and from them the intermetallics Al_7Cr and Al_3Zr, the former lower temperatures than the latter. Increase in size of the nuclei results in growth of the intermetallics. (tr-auth)

11971 STRENGTH AND DEFORMATION OF W-Ni-Fe AND W-Ni-Cu ALLOYS AT HIGH TEMPERATURES. Konyukhova, L. A.; Eiduk, Yu. A.; Vodop'yanova, L. S. Tsvetn. Metal.; No. 10, 57-59(Oct 1974). (In Russian).

The effect of the quantity of coupling phases on the properties of the alloys was established in the interval from 20 to 700°C. The curves of the change of ductile deformation as a function of temperature have maxima at 500°C. A decrease of the ductility in the interval from 500 to 700°C, possibly related to the decomposition of the coupling phases was noted. (tr-auth)

11972 TRANSITION ZONES OF THE BIMETALS Nb-Fe AND Nb-1Kh18N9T STEEL. Kharchenko, G. K.; Shevchuk, T. V.; Gordan, G. N. Tsvetn. Metal.; No. 10, 62-64(Oct 1974). (In Russian).

The transition zones of the bimetals in the original state and after high-temperature annealing were studied by x-ray structural, spectral, electronographic, and micro x-ray spectral analyses. The transition zones are characterized by the presence of niobium carbide inclusions and by layers of intermetallic compounds. Destruction of the bimetals occurs by layers containing NbC and Nb_2C. (tr-auth)

11973 USE OF THE INTERNAL FRICTION METHOD FOR THE EVALUATION OF THE PROPERTIES OF TUNGSTEN WIRES. Litvinova, I. I.; Yagofarov, V. Kh.; Burichenko, L. L. Tsvetn. Metal.; No. 10, 65-66(Oct 1974). (In Russian).

The proportional dependence of the shear modulus and the activation energy was established. The thermal stability, form stability, and creep tendency of W wires can be characterized by these values. Wires having $H > 6$ kcal/mol and $G > 12{,}700$ kG/mm^2 were evaluated qualitatively. (tr-auth)

11974 EVALUATION OF THE QUALITY OF TUNGSTEN WIRES. Nesgovorov, V. V.; Litvinova, I. I.; Pichkaev, N. A. Tsvetn. Metal.; No. 10, 66-67(Oct 1974). (In Russian).

It was established that according to the level of ductility and the character of its change during heating, it is impossible to distinguish wires with stratification from wires without stratification. Measurement of the shear modulus makes it possible to evaluate quantitatively the ductility of W wires. Wires with a shear modulus < 10,000 kG/mm^2 have a tendency to stratification. These data agree with the results of coiling. (tr-auth)

11975 THERMODYNAMIC PROPERTIES OF THE LIQUID ALLOYS OF THE TERNARY SYSTEM INDIUM-BISMUTH-MERCURY. Smirnova, O. Ya.; Nigmetova, R. Sh. Vestn. Akad. Nauk Kaz. SSR; No. 7, 47-52(Jul 1974). (In Russian).

The properties were studied by an isoteniscopic method for determining the Hg vapor pressure. The experimental values of the Hg vapor pressure were used to calculate some thermodynamic functions of the ternary system. On the basis of data on the binary boundary system, the thermodynamic functions of the ternary In-Bi-Hg system were calculated. The experimental and calculated data agree well with each other. (tr-auth)

11976 IMPROVEMENT OF THE IMPACT STRENGTH OF CAST STEEL BY MODIFICATION WITH YTTRIUM. Volchok, I. P.; Tsarev, A. V.; Rudenko, V. P. (Zaporozhe Machine-Building Inst., USSR). FKMMA; 10: No. 5, 111-112(1974). (In Russian).

Results of tests on the impact strength of ductility of a series of cast steels modified with Y were reported. It was shown that addition of Y increases the impact strength by factors of 2 to 4 at temperatures from 20 to -100°C. (tr-auth)

11977 LOCAL ENVIRONMENT EFFECTS IN $Gd(Co_xNi_{1-x})_2$ PSEUDOBINARY COMPOUNDS. Burzo, E.; Lazar, D. P.; Ciorascu, M. (Inst. for Atomic Physics, Bucharest). Phys. Status Solidi (b); 65: No. 2, K145-K148(1 Oct 1974).

Results of analyses of localization behavior of Co atoms in $Gd(Co_xNi_{1-x})_2$ are presented. The magnetic behavior of Co in this compound is interpreted using a local environmental model. (JRD)

11978 STRESS FIELD NEAR THE DISLOCATION PILE-UP TYPE DEFECTS IN ANISOTROPIC ELASTICITY. Solovev, V. A. (Inst. of Metallography and Metal Physics, Moscow). Phys. Status Solidi (b); 65: No. 2, 857-868(1 Oct 1974).

A general expression is obtained for the stress field at any point of infinite anisotropic crystals containing defects of the dislocation pile-up type (e.g., pile-ups, deformational twins, and cracks in thin crystals of martensite). The stresses are expressed in form of an analytic continuation of the density of dislocations from the line of the pile-up into the complex plane. The formulas obtained are valid for any geometrical arrangement of the defects, taking into account their non-zero Burgers vectors and giving stresses due to the defects only. The interaction of a line source (i.e., a line force and a dislocation simultaneously) with the mentioned defects is investigated. The results may be used for a unified description of the adhesion forces, non-linearity of the media, and plastic zone near the defects in terms of some integral coefficients. The concrete calculations are mainly reduced to the evaluation of the complex constants determining the stress field near a single dislocation. The constants are expressed and the stresses written in terms of elastic moduli for the defects lying in the direction of the orthotropic symmetry of the crystal. As a limiting case the general formulas for stresses near dislocation pile-ups in isotropic media are found. (auth)

11979 NMR OF ^{50}V IN SINGLE CRYSTAL VANADIUM. Hechtfischer, D.; Karcher, R.; Lueders, K. (Freie Univ., Berlin). Phys. Status Solidi (b); 65: No. 2, K89-K91(1 Oct 1974).

NMR measurements of ^{50}V in single-crystal natural vanadium are reported. The measurements were made at liquid He temperature. The exchange coupling constant for monocrystalline ^{50}V is estimated as $A/h \approx 200$ Hz. (JRD)

11980 LINEARIZED EFFECTIVE EXCHANGE AND CORRELATION POTENTIALS FOR ONE-PARTICLE PROPERTY CALCULATIONS IN SIMPLE METALS. Dagens, L. (Centre d'Etudes de Limeil, Villeneuve-Saint-Georges, France). Phys. Status Solidi (b); 65: No. 2, 481-492(1 Oct 1974).

The effective potential method of Sham and Kohn, which allows an exact calculation of one-particle properties in an interacting electron gas of slowly varying density, is extended to the case of an arbitrary varying density. Assuming a static approximation for the mass operator, it is shown that the elastic scattering cross section can be calculated exactly from an effective scattering potential $\tilde{V}$ which takes into account all vertex and self-energy corrections. The same potential leads also to the exact Fermi surface, at least to the lowest non trivial order in the density fluctuation $n(q)$. The matrix element of its indirect part $\tilde{V}_{xc} = \tilde{V} - V_H$ (V_H is the Hartree part of the potential) is linearized

as $\tilde{X}(q,k)$ $n(q)$ and the properties of the effective interaction $\tilde{X}$ are studied in great detail. The long wavelength limit $\tilde{X}(0,k)$ is related to the linearized Sham-Kohn one-particle effective potential. The behavior of $\tilde{X}$ in the whole range of q values is studied by means of numerical estimations, assuming a simple Thomas-Fermi screening approximation. $\tilde{X}(q,k)$ is found to be highly angular dependent (i.e., non local) and contact is made in this respect with a recent work of Yasuhara and Watabe. The simpler local interaction $\tilde{X}(q)$ (equal to $\tilde{X}(q,k)$ with $k = k_F = |k + q|$) which is required for electronic transport property calculations is also discussed and compared to the Kohn-Sham density-response effective interaction. (auth)

11981 SUPERCONDUCTING PROXIMITY EFFECT IN Ag–Mn. Ramos, E. D. (Rutgers–The State Univ., New Brunswick, NJ). Solid State Commun.; 15: No. 7, 1161-1165(1 Oct 1974).

The proximity effect was studied by measuring the thermal conductivity of double layer films made of a normal metal (Ag or Ag–Mn) and a superconductor (Pb–5% Bi), in the temperature range of 0.3 to 2 K. Thermal conductivity ratios have been used to estimate induced energy gap in silver and in dilute silver manganese alloys. No evidence for bound states in the presence of magnetic impurities was observed. (auth)

11982 MOESSBAUER ISOMER SHIFTS IN RARE EARTH COMPOUNDS. I. General Trends. Cashion, J. D.; Coulthard, M. A.; Prowse, D. B. (Monash Univ., Clayton, Australia). J. Phys., C (London); 7: No. 19, 3620-3632(7 Oct 1974).

Mössbauer-effect isomer shift measurements on seven different rare earths are compared to show the strong correlation which exists between isomorphous compounds or alloys of the 4f series. The comparison shows that the rare earth trifluoride represents a very good approximation to an ionic salt for isomer shift purposes. The isomer shifts of the divalent alloys of europium are shown to correlate very well with those of the trivalent alloys of the other rare earths and the "core" for europium in the metallic state is shown to be very different from a $4f^7$ configuration. (auth)

11983 MAGNETIC FIELD DISTRIBUTION OF SUPERCONDUCTING ALLOYS WITH SMALL MAGNETIZATION. Brandt, E. H. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi (b); 65: No. 2, 469-480(1 Oct 1974).

The magnetic field distribution of type-II superconductors with arbitrary concentration of non-paramagnetic impurities is calculated near H_{c2} for $0 \leq T < T_c$. At a certain temperature T, depending on the impurity concentration, minimum and saddle point of H interchange their positions. At very low T, the reduced magnetization $|4\pi M|\ B/N\ \langle|\Delta|^2\rangle$ reaches a maximum at a certain impurity concentration, but even a small concentration of paramagnetic impurities inhibits this effect. The new H leads to a correction of the $\varkappa_2$-theory. (auth)

11984 EFFECT OF FLUCTUATIONS ON ELECTRICAL CONDUCTIVITY OF ZERO-DIMENSIONAL SUPERCONDUCTORS BELOW T_c. Kumar, P.; Shukla, G. C. (Univ. of Roorkee, India). Phys. Status Solidi (b); 65: No. 2, K115-K117(1 Oct 1974).

The effects of fluctuations on the electric conductivity in zero-dimensional superconductors were calculated for temperatures below T_c using an exact averaging procedure. (JRD)

11985 ENERGY DISTRIBUTIONS OF FIELD EMITTED ELECTRONS FROM TUNGSTEN IN THE PRESENCE OF ADSORBED CO. Young, P.L.; Gomer, R. (James Franck Institute and Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). J. Chem. Phys. 61: No. 12, 4955-4972 (15 Dec 1974).

Energy distributions were measured on the (110), (100), (111), and (210) planes under various conditions of CO adsorption. Resonances were seen for the low temperature layer at −7 to 7.5 eV below vacuum on all planes except (100). A comparison of the widths and maximum amplitudes of the resonances shows good agreement with the theory of field emission from adsorbate covered surfaces. On heating, the resonances disappeared at $\leq$ 350 K, corresponding to conversion of the low temperature states to beta–precursor states. Readsorption on beta or beta–precursor layers led to resonances at −7 eV on (210) and (111), but not on (110) or (100). The resonances are interpreted as arising from interaction of CO–π^* orbitals with tungsten d–t_{2g} orbitals in adsorption via the C atom on single W atoms. Disappearance of the resonances on heating is interpreted as activated rearrangement to new bonding configurations—for instance, bridge bonding via C–sp^2 orbitals. The intensity of the resonances increases initially with coverage but, on all planes except (210), goes through a maximum and vanishes for $\theta < 1$. This is interpreted as interference of neighboring CO molecules, resulting in the squeezing out of charge from the labile–π orbitals responsible for the resonance. The details of intensity vs θ curves on different planes support this model. On the (100) plane, a resonance at −6.9 eV appeared at 600 K and is attributed to W–O bonding. A comparison of the temperature behavior of this resonance for O and CO covered emitters leads to the conclusion that CO on the (100) plane is rearranged but not dissociated up to at least 820 K. (auth)

11986 MICROANALYTICAL STUDY OF $M_{23}C_6$ CARBIDES AS A FUNCTION OF AGEING TIME IN Nb-BEARING AUSTENITIC STEELS. Adamson, J. P.; Martin, J. W. (Oxford Univ.). Metallography; 7: No. 5, 397-402(Oct 1974).

A microanalyzing electron microscope (an AEI EMMA 4 instrument) has been used to measure the Nb content of intergranular $M_{23}C_6$ particles as a function of aging time at 750°C in a series of 20Cr–25Ni austenitic stainless steels of differing C/Nb ratio. It is found that in a given alloy the amount of Nb in $M_{23}C_6$ increases as the particle size and/or aging time increases. For a given size of carbide, it is found that an increase in the aging time leads to a greater increase in Nb content the higher the C/Nb ratio of the alloy. The results may be understood when the overall precipitation behavior of the alloys is considered. (auth)

11987 DISLOCATION DYNAMICS OF MOLYBDENUM SINGLE CRYSTALS IN THE MICROPLASTICITY REGION. Leiko, E.B.; Nadgornyi, E.M. (Institute of Solid–State Physics, Academy of Sciences of the USSR). Sov. Phys.–Crystallogr. 19: No. 3, 363-366 (Nov 1974).

Some features are reported for the dislocation dynamics of zone–purified Mo single crystals at small stresses corresponding to the microplasticity region. The structure of the dislocation patterns is examined for {100} surfaces, these being determined by the glide system. There are found to be stress regions that differ in the characteristics of the motion and the dislocation multiplication, and estimates are made for the dislocation velocity. It is found that screw dislocations are exceptionally mobile in these crystals. (auth)

11988 ELECTRONIC EXCITATIONS (3 TO 35 eV RANGE) IN SOME LAYERED III TO VI COMPOUNDS: GaS, GaSe, AND InSe. Soukiassian, P.; Cazaux, J.; Perrin, J. (Faculte des Sciences, Reims). Phys. Status Solidi (b); 66: No. 1, 151-160 (1 Nov 1974).

The energy losses suffered by a 40-keV electron beam through some monocrystalline layered III–VI compounds were measured. By means of a Kramers Kronig analysis, the complex dielectric constant, in the 3- to 35-eV energy range, is computed for GaS ($\parallel$ and $\perp$ to c-axis), GaSe ($\parallel$ and $\perp$ to c-axis), and InSe ($\perp$ to c-axis) and the ϵ_2 sum rule is applied. Attempts of interpretation are suggested with a special attention for the outer shell core electron excitations. (auth)

11989 INFLUENCE OF RARE EARTH METALS ON SUPERCONDUCTIVITY OF VANADIUM, NIOBIUM, AND TANTALUM. Savitskii, E. M.; Efimov, Yu. V.; Kozlova, N. D.; Zvolinskii, O. I. (Inst. of Metallurgy, Moscow). Dokl. Akad. Nauk SSSR; 213: No. 4, 826-829(1 Dec 1973). (In Russian).

The effect of rare earths on the transition temperature of V, Nb, and Ta to the superconducting state was studied for the rare earths. Types of phase diagrams of binary systems of V, Nb, and Ta with Sc, Ce, Er, and Lu are given. Alloying V, Nb, and Ta with Sc in the limits of the solid solution leads to an increase of T_c of these elements. Some increase of the T_c of V and Ta was observed during alloying with Y, but no increase was observed for Nb. A small increase of T_c was observed during alloying with Lu. The other rare earth metals decrease the T_c of V, Nb, and Ta. The significance of these results are discussed. (JSR)

11990 MAGNETIC SUSCEPTIBILITY OF TRANSITION METALS WITH NO MAGNETIC ORDER. Galoshina, E. V. (Inst. of Metal Physics, Sverdlovsk, USSR). Usp. Fiz. Nauk; 113: No. 1, 105-128(May 1974). (In Russian).

A review (93 references) is presented on aspects of the magnetic susceptibility of the transition metals which do not have a magnetic index–ferro- or antiferromagnetic. The basic components of the magnetic susceptibility of the transition metals are considered, and theoretical estimates of these components and of the complete paramagnetic susceptibility for different metals are given. Experimental results on the susceptibility of the transition metals and its temperature dependence are compiled, and methods used for separating the different components of the susceptibility are described. Results of studies on the susceptibility of monocrystals and hexagonal densely packed structures are analyzed. Theoretical estimates are compared with experimental results. (tr-auth)

11991 ANOMALOUS CONCENTRATION DEPENDENCE OF THERMAL EXPANSION COEFFICIENTS OF TUNGSTEN–RHENIUM AND TUNGSTEN–NIOBIUM ALLOYS. Zaichenko, V. M.; Klimenko, Yu. A.; Mints, R. G.; Petukhov, V. A.; Chekhovskoy, V. Ya. (Inst. of High Temperature, Moscow). pp 273-278 of Proceedings of the Sixth Symposium on Thermophysical Properties. Liley, P. E. (ed.). New York; American Society of Mechanical Engineers (1973).

From 6th symposium on thermophysical properties; Atlanta, Georgia, USA (6 Aug 1973). See CONF-730851-.

The thermal expansion of alloys of W with Re or Nb has been investigated in the temperature range of 200 to 900°C, with the concentration of the alloying component varying from 1 to 30 at. %. Anomalous peaks have been observed in the curves of concentration dependence of mean thermal expansion coefficients. The results obtained are discussed. (Metals Abstr.)

11992 LORENZ NUMBER AND THERMAL CONDUCTIVITY OF LIQUID Ga, Hg, AND Hg–In. Busch, G.; Guntherodt, H. J.; Haller, W.; Wyssman, P. (Swiss Federal Inst. of Tech., Zurich). pp 347-352 of Proceedings of the Sixth Symposium on Thermophysical Properties. Lilley, P. E. (ed.). New York; American Society of Mechanical Engineers (1973).

From 6th symposium on thermophysical properties; Atlanta, Georgia, USA (6 Aug 1973). See CONF-730851-.

The Lorenz number of liquid high-purity Ga, Hg, and Hg–In alloys has been carefully measured directly by applying the Kohlrausch method to a constriction-shaped sample. Temperature independent values were obtained with deviations <1% from the theoretical free electron value for the Lorenz number. The thermal conductivity has been calculated from the Lorenz number and the electrical conductivity by means of the Wiedemann–Franz law. (Metals Abstr.)

11993 ELECTRONIC STRUCTURE OF CESIUM UNDER PRESSURE. Louie, S.G.; Cohen, M.L. (Department of Physics, University of California, Berkeley, California 94720 and Inorganic Materials Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). Phys. Rev. B 10: No. 8, 3237-3245 (15 Oct 1974).

Using the pseudopotential method we have calculated the band structure, the density of states, and the charge density for the conduction electrons in Cs for three cell volumes. The system was assumed to be fcc and the cell volumes V were chosen equal to $0.5V_0$, $0.4V_0$, and $0.3V_0$ where V_0 is the cell volume at normal pressure. Analysis of the density of states and electronic charge density as a function of volume shows that the conduction electrons become more d like as the volume contracts. The s–d transition appears to be continuous rather than abrupt. The band structure and electronic charge densities indicate that cesium is a transition metal at high pressures. The superconductivity of cesium under high pressure is discussed in terms of the charge distribution of the conduction electrons. (auth)

11994 CURRENT–VOLTAGE CHARACTERISTICS OF SUPERCONDUCTING Pb FILMS IN CONTACT WITH A NORMAL METAL. Baker, J.W.; Mitchell, E.N. (Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27514). Phys. Rev. B 10: No. 11, 4593-4597 (1 Dec 1974).

We have observed step structure in the current–voltage characteristics of single–crystal and polycrystal Pb films in parallel applied magnetic field near H_{c2} of the film. The single–crystal films are in direct contact with a normal metal which suppresses surface superconductivity on that side of the film. These films exhibit the same type of step structure in their I–V curves as do Pb films deposited directly onto glass substrates. (auth)

11995 ISOTOPE EFFECT IN SUPERCONDUCTING β–PHASE GALLIUM. Parr, H. (Fysisk Institutt, Universitetet i Oslo, Oslo 3, Norway). Phys. Rev. B 10: No. 11, 4572-4576 (1 Dec 1974).

The superconductive isotope effect in β–phase Ga has been investigated in small single spheres of ^{69}Ga and ^{71}Ga. The difference in transition temperatures is $\Delta T_c = 73 \pm 3$ mK. Assuming a dependence on the mean isotopic mass of the form $T_c \sim M^{-\alpha}$, this yields $\alpha = 0.43 \pm 0.02$. The transition temperatures are $T^{69}{}_c = 6.10 \pm 0.02$ K and $T^{71}{}_c = 6.02 \pm 0.02$ K. Our previously published value for T_c in β–Ga is too low owing to an incorrect thermometer calibration. The correct value is $T^{\beta}{}_c = 6.07 \pm 0.03$ K for natural β–Ga. $H_c(T)$ has been measured both for ^{69}Ga and ^{71}Ga. At $T = 0$, the difference in critical field is $H^{69}{}_0 - H^{71}{}_0 = 5 \pm 2$ Oe, in agreement with the similarity principle. Within the experimental accuracy, the deviation of $H_c(T)$ from a parabola is independent of isotopic mass, yielding $D(t^2)_{max} = -0.021 \pm 0.004$. The slope $(dH_c/dT)|_{T_c} = 155 \pm 2$ Oe/K, independent of isotopic mass to this accuracy. These results show β–Ga to be a rather typical weak–coupling superconductor. (auth)

11996 SPECIFIC HEAT AND RESISTIVITY OF GADOLINIUM NEAR THE CURIE POINT IN EXTERNAL MAGNETIC FIELDS. Simons, D.S.; Salamon, M.B. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Rev. B 10: No. 11, 4680-4686 (1 Dec 1974).

A modification of the ac calorimetric technique has been used to test the proportionality of the specific heat and temperature derivative of the basal–plane resistivity of gadolinium through the Curie point. Because of a large temperature–dependent background to the resistivity derivative, a direct comparison of the critical contributions to the two quantities was impossible. It was found, however, that the background was insensitive to applied magnetic fields so that a direct comparison of the deviation of the specific heat at a finite field from its zero–field value with the similar deviation of the resistivity derivative demonstrated the proportionality of the two quantities. In applied fields below 585 Oe, a "kink point" was observed in the specific heat below T_c which moved to lower temperatures with increasing fields. Such an effect has been predicted to occur at fields and temperatures for which the internal magnetic field vanishes. The specific heat in several fields above 585 Oe was compared with the predictions of scaling laws and with the linear approximation to the parametric equation of state. Reasonable agreement between the data and the specific–heat scaling function predicted by the linear model could only be obtained by using an unrealistic value of the critical exponent describing the zero–field specific heat. (auth)

11997 THEORY OF DYNAMIC QUADRUPOLE SPIN RELAXATION–APPLICATION TO Ta NUCLEI WITH MOBILE HYDROGEN IMPURITIES. Fedders, P.A. (Laboratory for Ultrasonics, Physics Department, Washington University, St. Louis, Missouri 63130). Phys. Rev. B 10: No. 11, 4510-4514 (1 Dec 1974).

A general formalism is developed for obtaining the relaxation rates for electromagnetically or acoustically excited nuclear or electronic spins interacting with a fluctuating quadrupole electric field. The results are expressed in terms of the correlation functions of the quadrupole field. Examples of such fields are those due to phonons, conduction electrons, and mobile charged impurities. In particular, we calculate the relaxation rate of Ta nuclear spins due to the field gradients generated by mobile hydrogen impurities. The results are in good agreement with nuclear–acoustic–resonance experiments on Ta. (auth)

11998 LATTICE VIBRATIONS IN HCP $Y_{0.9}Tb_{0.1}$ IN THE COHERENT–POTENTIAL APPROXIMATION. Mostoller, M.; Kaplan, T.; Wakabayashi, N.; Nicklow, R.M. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. B 10: No. 8, 3144-3149 (15 Oct 1974).

The coherent–potential approximation (CPA) for a mass–disordered random alloy is applied to the hcp rare–earth metal alloy $Y_{0.9}Tb_{0.1}$. The results of full hcp CPA calculations are in good agreement with inelastic neutron scattering measurements of the phonon frequency shifts and intrinsic linewidths for this system. When cubic CPA formulas are used to describe the hcp alloy, much poorer agreement with experiment is obtained. (auth)

11999 CONTRIBUTION TO THE SAMARIUM–COBALT PHASE DIAGRAM. Williams, K. L. (Stanford Univ., CA); Bartlett, R. W.; Jorgensen, P. J. J. Less-Common Metals; 37: 174-176(1974).

Solvus compositions for $SmCo_5$ and Sm_2Co_{17} and Sm-saturated Co were studied by electron-beam microprobe analysis of phases in annealed specimens. The $SmCo_5$ compound shows an increasing range of homogeneity with increasing temperature up to very close to the peritectic temperature of 1320°C. This phase exhibits both hyperstoichiometric and hypostoichiometric compositions. The maximum content of samarium in the $SmCo_5$ compound is about 1 wt.% greater than the stoichiometric composition, corresponding to the composition $SmCo_{4.8}$, and this solvus composition does not vary significantly with temperature. The Sm_2Co_{17} compound melts congruently at 1335°C, and it exhibits a narrow range of homogeneity at temperatures near its melting point. The homogeneity range broadens somewhat as the annealing temperature decreases. This compound is never hyperstoichiometric, and the cobalt-saturated solvus is an isopleth that coincides with the stoichiometric composition of Sm_2Co_{17}. (JRD)

12000 PLASTIC DEFORMATION BY UNIAXIAL DYNAMIC STRESS OF THE SURFACE LAYERS OF SINGLE CRYSTALS OF SILICON, MOLYBDENUM, AND NIOBIUM. Shorshorov, M. Kh. pp 144-151 of Struktura i svoistva monokristallov tugoplakikh metallov. Moscow; Nauka (1973). (In Russian).

Electron microscopy and metallography were used to study the effect of small deformations on the dislocation distribution across the section of Si, Mo, and Nb single crystals during dynamic compression along one of the principal crystallographic directions. Up to a certain value of deformation for each metal the plastic flow is localized in a fine near-surface layer of the crystal. This effect results in an increased dislocation density at the surface. (Referativnyi Zh.)

12001 LATTICE PARAMETERS OF $(Co_{3.5}Cu_{1.5})Pr_{1-x}Y_x$ AND $(Co_3Ni_2)Pr_{1-x}Y_x$ ALLOYS. Green, M. L. (Bell Telephone Labs., Murray Hill, NJ). J. Less-Common Metals; 37: 169-170(1974).

Results of an investigation are presented in which y, having a small trivalent ionic radius (0.93 Å) as compared with Pr(1.09 Å), was progressively substituted for Pr in $(Co_{3.5}Cu_{1.5})Pr$ and $(Co_{3.5}Cu_{1.5})Pr$. It was found that any change in cell size caused by substitution of one rare-earth atom for another is confined to the basal plane and therefore reflected in the A_0 parameter, with no

component along the Co parameter line. The fact that A_0 shrinks as y is added to the Pr alloys is additional evidence for the formation of a solid solution, since y has a smaller ionic radius than Pr. (JRD)

12002 INVESTIGATION OF THERMAL CONDUCTIVITY AND ELECTRICAL CONDUCTIVITY OF DISPERSED MATERIALS MADE OF URANIUM AND MOLYBDENUM DIOXIDES. Kakushadze, L. E.; Kotel'nikov, R. B. Sov. J. At. Energy (Engl. Transl.); 36: No. 2, 166-167(Feb 1974).

Translated from At. Energ. (USSR); 36: No. 2, 136(Feb 1974).

The thermal and electric conductivities of cermets of particulate UO_2 coated with Mo metal and Mo powder were measured. It was found that cermets with a particle diameter of −315 to +200μ the thermal and electric conductivities can be represented by equations and the relation between the thermal and electric conductivity can also be represented by an equation. These equations are included. (JRD)

12003 SIMULATION OF THE POINT DEFECT BEHAVIOR IN A LATTICE BY THE MONTE-CARLO METHOD. Lanore, J. M. (CEN, Fontenay-aux-Roses, France). Radiat. Eff.; 22: No. 3, 153-162(1974).

The simulation of the point defect behavior in a lattice by the Monte-Carlo method can be made very fast by using probability laws as a function of time for each possible event (creation, annihilation or transformation of a defect), thus avoiding the treatment of each elementary jump. The simulation techniques are described, and some examples of application are given: annealing of a cascade, quenchings, isochronal anneals, and interstitial clustering during electron irradiation. Comparisons with other calculation methods and with experiments show the validity and efficiency of these techniques. (auth)

12004 AMERICIUM METALLIDES: AmAs, AmSb, AmBi, Am_2Se_4, AND $AmSe_2$. Roddy, J. W. (Oak Ridge National Lab., TN). J. Inorg. Nucl. Chem.; 36: No. 11, 2531-2533(Nov 1974).

The crystal structures of several americium metallides were determined using the long-lived americium-243 isotope. Three of the binary systems produced alloys near the equiatomic compositions (AmAs, AmSb, and AmBi), which were found to have the NaCl-type structure. Two compounds were identified in the Am-Se system: (1) Am_2Se_4, which was found to have a bcc structure and (2) $AmSe_2$ (less certain), with a tetragonal structure. The lattice parameters, calculated and observed d-spacings, and calculated and observed line intensities for these compounds are reported. (auth)

12005 TEMPERATURE DEPENDENCE OF THE SINGLE−ION ANISOTROPY ENERGY IN RARE EARTH METALS. Kazakov, A.A. (A. M. Gor'kii Ural State University). Sov. Phys.−Solid State 16: No. 5, 893-894 (Nov 1974).

Simple equations are found for the constants of the single−ion anisotropy energy for the limiting cases of low and high temperatures. The effect of the finite magnitude of the spins on the temperature dependence of the constants is discussed. The equations derived are used to calculate the anisotropy in the paramagnetic susceptibility of rare earth metals in strong magnetic fields. (auth)

12006 ELECTROMIGRATION AND PERMEATION OF HYDROGEN AND DEUTERIUM IN SILVER. Einziger, R. E.; Huntington, H. B. (Rensselaer Polytechnic Inst., Troy, NY). J. Phys. Chem. Solids; 35: No. 12, 1563-1573(Dec 1974).

A steady state flow technique was used to measure the effective charge number (Z^*) and permeability (N) of hydrogen and deuterium in silver. Over the range of temperature (485 to 720°C) and pressure (220 to 750 torr) the effective charge number is a constant. The interstitial impurity migrates in the direction of the electron wind with $Z_H^* = -6.8$ and $Z_D^* = -18$. The values of Z^* are of the same order as self-electromigration but the size of the isotope effect is surprising. The quantum theories used to explain the isotope effect for hydrogen electromigration in Fe and Ni appear to fail here. In order to determine the effective charge number it was necessary to measure the permeability. For both H_2 and D_2, the permeability in silver follows the equation $N = N_O \exp(-Q/RT)$ where $N_{OD} = 2.39 \pm 0.40$, $Q_D = 14400 \pm 300$, $N_{OH} = 2.86 \pm 0.70$ and $Q_H = 14200 \pm 500$. Here Q is in units of cal/mol and N is in units of $cc(ntp)/(sec - atm^2 - cm)$. The isotope effect ratio, $N_H/N_D = 1.25$ was smaller than the classically expected value of $(2)^{½}$, but could be explained by the theory of Ebisuzaki, Kass and O'Keeffe (J. Chem. Phys.; 46: 1373(1967)). (auth)

12007 SIZE EFFECTS IN RHENIUM THIN FILMS. Lakh, K. I. (L'vovskij Gosudarstvennyj Univ. (Ukrainian SSR)). Fiz. Elektron.; 5: 105-107(Oct 1972). (In Russian).

A study was made of the effect of film thickness on the electrical conductivity and the Hall effect in thin rhenium films. A technique was developed to obtain thin rhenium films under conditions of very high vacuum. From the experimental data by means of the theory of Fuksasondheimar it was possible to determine the mean free path of the current carriers at various temperatures. (tr-SJR)

12008 EFFECT OF ADSORPTION ON ELECTRIC CONDUCTIVITY OF VANADIUM THIN FILMS. Lakh, K. I.; Stasyuk, Z. V. (L'vovskij Gosudarstvennyj Univ. (Ukrainian SSR)). Fiz. Elektron.; 5: 102-104(Oct 1972). (In Russian).

The effect of the adsorption of Ba on the electrical conductivity and work function of granular and relatively thick (d > 50 Å) films of V obtained by thermal evaporation in a superhigh vacuum was studied. It was shown that a significant change of the conductivity was observed only in cases of granular films. A study was made of the dependence of the conductivity of the V films on their thickness. (tr-auth)

12009 EFFECT OF ADSORPTION OF BARIUM OXIDE ON THE ELECTRICAL PROPERTIES OF THIN SCANDIUM FILMS. Panchishin, R. S. (L'vovskij Gosudarstvennyj Univ. (Ukrainian SSR)). Fiz. Elektron.; 5: 100-101(Oct 1972). (In Russian).

The effect of the adsorption of barium oxide molecules on the electroconductivity and work function of thin Sc films, deposited under high vacuum conditions (residual gas pressure $p = 1$ to 8×10^{-9} torr) was studied. The adsorption leads to a decrease of the work function of the film. Measurement of the resistance shows a very complex dependence on the degree of coating of the film by the adsorbed molecules. (tr-auth)

12010 MOLYBDENUM AND TUNGSTEN EFFECT ON THE CRYSTALLIZATION CRACKING RESISTANCE. Lejnachuk, E. I.; Podgaetskij, V. V.; Parfessa, G. I. (AN Ukrainskoj SSR, Kiev. Inst. Ehlektrosvarki). Avtomat. Svarka; No. 11, 9-13(Nov 1973). (In Russian).

For English translation see the journal Autom. Weld.

In experiments with carbon steels, alloying with Mo decreased the tendency of the fused metal to crack. Increasing the Mo concentration, completely eliminated the defects up to a limiting concentration, and then excess Mo caused cracks to reappear. Alloying with W also increased the resistance to cracking but increasing the W never completely eliminated the defects. In the presence of Mo the structure of the fused metal was broken up, with formation of carbides, carbide eutectics, and intermetallic phases, while films and other types of sulfide inclusions became rounded, smaller, and more refractory. Up to a limiting Mo content, there was equilibrium phase dispersion, with increased resistance of the fused metal to crystallization cracking. With excess Mo the amount of carbide eutectic and intermetallic phase increased, causing coarsening, while the resistance to cracking decreased. The effect of W was similar to that of Mo but smaller. Only WC was formed—no carbide eutectic or intermetallic phase was observed. (tr-auth)

12011 EFFECT OF HEAT TREATMENT ON THE STRUCTURE AND PROPERTIES OF COMPOUNDS OF THE Nb−1% Zr−0.1% C ALLOY. Gurevich, S. M.; Nerodenko, M. M.; Asnis, E. A.; Rabkina, M. D.; Fortunatova, N. N.; Doroshenko, L. K. (AN Ukrainskoj SSR, Kiev. Inst. Ehlektrosvarki); Tkachenko, V. G. (AN Ukrainskoj SSR, Kiev. Inst. Metallofiziki). Avtomat. Svarka; No. 11, 58-60(Nov 1973). (In Russian).

For English translation see the journal Autom. Weld.

The characteristics of the structure and properties of compounds of the Nb alloy of the Nb−Zr−C system were studied as a function of the thermal processing regime. The studies were made with electron and optical microscopy, measurement of the internal friction, and mechanical tests. The optimum temperature for annealing seams of the Nb−1% Zr−0.1% C is 1150 to 1200°C. As a result of thermal processing at these temperatures active dissolution of the spicular precipitates occurs at the boundaries and in the grain with subsequent formation of stable finely dispersed particles. (tr-auth)

12012 THERMAL CONDUCTIVITY OF RHENIUM. Peletskii, V. E.; Sobol', Ya. G.; Amasovich, E. S. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). High Temp. - High Pressures; 5: No. 1, 9-12(1973).

From 3rd European conference on thermophysical properties; Turin, Italy (20 Jun 1972).

Measurements are reported on the electrical and thermal conductivities of rhenium within the temperature range 1200 to 2400°K. The thermal conductivity was measured on a sample 8 mm in diameter and 70 mm in length using a modified longitudinal heat flow method in conjunction with heating the sample by electron bombardment. It is estimated that the smoothed values are accurate to ±5.0%. The results are compared with data available in the literature. Temperature variation of the Lorenz num-

ber for rhenium and the mechanism of conduction are discussed. (auth)

12013 EFFECT OF RARE EARTHS ON THE STRUCTURE AND PROPERTIES OF 20K AND 12Kh1MF BOILER STEELS. Rychkov, A. P.; Lanskaya, K. A.; Tyurin, E. I. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Chernoj Metallurgii, Moscow (USSR)). Stal; No. 10, 930-932(Oct 1973). (In Russian).

For English translation of selected articles see the journal Stal USSR.

The effect on properties of adding rare earths to boiler steels (0.2-3.0 kg/t) was studied in the laboratory and under production conditions. Addition of 0.8 kg of rare earths per ton to the ladle decreased the amount of nonmetallic inclusions, particularly sulfides. The crystal strength was increased (due to purification from inclusions), both at high temperatures, near the crystallization point, and at room temperature. Plasticity and impact viscosity in 230- to 250-mm billets and in tubes increased. (tr-auth)

12014 EFFECT OF DISPERSION HARDENING ON A TREND OF WELDED JOINTS OF Cr-Mo-V STEELS TOWARDS BRITTLE FAILURES AT HIGH TEMPERATURES. Shron, R. Z.; Nikanorova, N. I.; Krechet, L. Eh.; Zemzin, V. N.; Zhitnikov, N. P. Svar. Proizv.; No. 12, 1-3(Dec 1973). (In Russian).

For English translation see the journal Weld. Prod.

It is shown that the effect of dispersion hardening on overheated sections results in a tendency of welded joints of heat-resistant, chromium-molybdenum steels to local brittle failure at high temperatures during thermal treatment in non-annealed or slightly annealed states. Thermal treatment by a mode of high annealing, which assures recrystallization in sections of dispersion hardening, increases the plasticity and resistance of welded joints to brittle failure during use. In order to avoid the formation of cracks during the thermal treatment the temperature of holding the welded steam tubes made of 15 Kh1M1F steel should be at least 720°C on taking into account possible deviations of the thermal welding operation from the recommended conditions and the presence of stress concentrators. (tr-SJR)

12015 STRUKTURA FAZ, FAZOVYE PREVRASHCHENIYA I DIAGRAMMY SOSTOYANIYA METALLICHESKIKH SISTEM. (Phase Structure, Phase Transformations, and Phase Diagrams of Metallic Systems. Conference Held at Moscow, USSR, September 18-21, 1972). Ivanov, O. S.; Alekseeva, E. M. (eds.). Moscow; Izdatel'stvo Nauka (1974). 220p. (CONF-7209120-).

The 52 papers presented at the Conference are compiled. Separate abstracts were prepared for 32 of them. (JSR)

For abstracts of individual papers see: 11821-11825 and 12016-12042.

12016 RELATION OF THE CHARACTER OF THE NUCLEATION OF THE CARBIDE PHASE IN CAST MOLYBDENUM ALLOYS TO THE TEMPERATURE DEPENDENCE OF THE SOLUBILITY OF CARBON IN MOLYBDENUM. Ageev, N. V.; Bokareva, N. N.; Ignatov, D. V.; Kantor, M. M.; Model, M. S.; Romanchenko, S. G. pp 5-12 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyanniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Characteristics of the decomposition of solid solutions of Mo with C, Hf, Zr, and Fe were studied by diffraction electron microscopy and x-ray structural analysis. It was established that two mechanisms of nucleation of the carbide phases (homogeneous and inhomogeneous) are possible during decomposition. The original degree of supersaturation of the solid solutions with carbon, very dependent on the conditions of nonequilibrium crystallization of the ingot, determines the nucleation mechanism. At large supersaturation the homogeneous mechanism predominates, but at low supersaturation the heterogeneous nucleation of precipitates of the carbide phase predominate. However, the local character is independent of the decomposition mechanism. Change of the original degree of carbon supersaturation of the solid solution by microalloys with some metals can, under the given conditions of crystallization, predetermine the predominant nucleation mechanism. (DLC)

12017 CHARACTERISTICS OF THE ELECTRON STRUCTURE OF THE σ PHASES OF THE TUNGSTEN-RHENIUM SYSTEM. Budagovskii, S. S.; Bykov, V. N.; Gavrilyuk, M. I.; Ivanyushkin, E. M.; Rudnev, I. I.; Solov'ev, V. A. pp 13-18 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyanniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauko (1974). (In Russian).

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The concentration dependence of the magnetic susceptibility of alloys of the W-Re system up to 45 at. % Re and the nuclear γ resonance spectra of ^{57}Fe in W, Re, and their alloys whose compositions correspond to the region of the β solid solutions, two-phase regions, and σ phases, were determined experimentally. During formation of the σ phases, there is substantial redistribution of the electrons between atoms having nonequivalent points in their crystal lattice and formation of nonmetallic bonds. (tr-auth)

12018 INTERACTION OF ZIRCONIUM WITH THE TRANSITION METALS OF THE IRON AND SILICON FAMILIES. Lysenko, L. A.; Ban, Z.; Yarmolyuk, Ya. P.; Gladyshevskii, E. I. pp 21-25 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyanniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Isothermal cross sections of the phase diagram of the Zr-{Fe, Co}-Si system were studied at 800°C by x-ray structural and microstructural methods. In both systems, seven intermetallic compounds are formed. Most of them are related to known structural types. For some compounds the first step of monocrystallization studies were made. The solubility of the components in the binary compounds was studied. Comparative characteristics of the Zr-{Fe, Co, Ni}-Si system are given. (tr-auth)

12019 EFFECT OF THE COOLING RATE ON THE STRUCTURE OF THE EUTECTIC OF THE IRON-BORON SYSTEM. Nakaidze, Sh. G.; Garibashvili, V. I.; Zoidze, N. A.; Tavadze, G. F.; Tavadze, F. N. pp 36-38 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The effect of the cooling rate on the morphology and phase structure of the eutectic of the Fe-B system was examined. It was shown that a transition from a cooperative dendrite growth to a homogeneous nucleation and distinct growth of the phase forming the eutectic occurs according to the extent of the increase of the cooling rate. The eutectic, formed as a result of cooling at a rate $>10^6$ °/sec, consists of crystals of α-Fe and the monoboride FeB, which replaces the equilibrium phase Fe_2B in the structure. The observed change in the structure of the eutectic is connected with the characteristics of a short-range order in the liquid melts. (tr-auth)

12020 CRYSTALLOGRAPHY OF THE DISPLACEMENT TRANSITION $\gamma \rightarrow \alpha'$ AND SOME CHARACTERISTICS OF THE METASTABLE PHASE IN URANIUM ALLOYS. Sofronova, R. M.; Ivanov, O. S. pp 42-48 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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In medium alloyed U alloys with Mo, Nb, Zr, and other elements, the $\gamma \rightarrow \alpha'$ conversion during quenching proceeds through compositions with structure of the γ^s, γ^0, α_b phases. The lattices of the initial γ and final α phase exist in the oriented relations $\{111\}_\gamma \parallel \{100\}_\alpha$, $\{112\}_\gamma \parallel \{010\}_\alpha$, $\{110\}_\gamma \parallel \{001\}_\alpha$. The kinetics of the conversion $\gamma \rightarrow \gamma^s \rightarrow \gamma^0 \rightarrow \alpha_b'' \rightarrow \alpha_b'$ characterize it as massive. The morphology of the γ^0, α_b'', and α_b' phases is striated. The twins {130}, {021}, experimentally detected, were not confirmed by the theory of the crystallography of martensite which indicates its inapplicability to the $\gamma \rightarrow \alpha'$ conversion. (tr-auth)

12021 KINETICS OF THE DISPLACEMENT TRANSITION $\gamma \rightarrow \alpha'$ IN URANIUM ALLOYS AND METASTABLE PHASES IN THE U-Nb-Mo SYSTEM. Kushnir, N. P.; Sofronova, R. M.; Ivanov, O. S. pp 48-54 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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In medium-alloyed U alloys with Mo, Nb, and Zr in the metastable state, correlations were observed between the dependence of the degree of development of the $\gamma \rightarrow \gamma^s \rightarrow \gamma^0 \rightarrow \alpha'' \rightarrow \alpha'$ transition on the cooling rate during quenching and the changes of structure of the metastable phase during low-temperature annealing. The most complex displaced transition during annealing—exchange of the reverse path $\alpha' \rightarrow \alpha'' \rightarrow \gamma^0$ with the direct $\gamma^0 \rightarrow \alpha''$ path—was observed in alloys of the U-Nb-Mo system. Reasons for the complex pattern of displaced transition in U alloys are possibly ex-

plained by the effect of quenching vacancies and vacancies appearing as a result of quenching stresses. (tr-auth)

12022 PHASE TRANSFORMATION IN TITANIUM AND ZIRCONIUM IN SHOCK WAVES. Kutsar, A. R.; German, V. N.; Nosova, G. I. pp 55-57 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Data on the phase transformation in Ti and Zr during static and dynamic pressures were examined. On the basis of the T-p conditions of the shock compression, it was shown that the appearance of β phases in Ti after explosion processing is connected with secondary processes on the surface of the sample. An evaluation was made of the residual temperatures after passage of the shock wave. Heating of Ti and Zr by shock waves of 120, 200, 350, and 500 kbar was done at 293 and 120°K. It was established that after passage of the 350-kbar wave at 120°K, a significant quantity of the ω phase was formed in the Ti samples. In Zr, the ω phase was detected after heating with pressure of 120 kbar at 293°K. (tr-auth)

12023 HYSTERESIS OF THE PHASE TRANSFORMATION IN IRON, TITANIUM, AND ZIRCONIUM AT HIGH PRESSURES. Zil'bershtein, V. A.; Estrin, E. I. pp 58-61 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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An experimental evaluation was made of the hysteresis during the $\alpha \rightarrow \epsilon$ transformation in Fe and the $\alpha \rightarrow \omega$ transformation in Ti and Zr. The existence of significant hysteresis of these transformations was shown at temperatures close to room temperature. On the basis of the results, corrected T-p diagrams for Fe, Ti, and Zr were proposed. (tr-auth)

12024 KINETICS OF THE POLYMORPHOUS TRANSFORMATION IN ZIRCONIUM. Mal'tseva, G. K.; Piterimov, V. A. pp 61-64 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Experimental results are given on the temperature dependence of the relative specific electric resistivity and the relaxation of the conductivity for Zr at 400 to 1000°C. In the discussion of literature on internal friction and intrinsic changes, an attempt was made to explain the physical nature of the pre-transition phenomena during phase transformation in Zr. An assumption was made on the supplementary ionization of atoms long before and up to the temperature of polymorphous transformation. (tr-auth)

12025 PHASE DIAGRAM AND CHARACTERISTICS OF THE $\gamma \rightleftharpoons \alpha$ TRANSFORMATION OF CERIUM AT HIGH HYDROSTATIC PRESSURE. Kutsar, A. R. pp 76-80 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

By means of dilatometric and piezometric measurements, the $\gamma \rightleftharpoons \alpha$ transformation in Ce was studied at high hydrostatic pressures. The following characteristics of the $\gamma \rightleftharpoons \alpha$ conversion were detected: the presence of kinetics of isothermal martensite conversion and the absence of the effects of phase hardening and phase stabilization during abnormally high volume effect of 14.5% at 293°K; the presence of abnormal compressibility factors and thermal expansion of the γ and α phases near the $\gamma \rightarrow \alpha$ and $\alpha \rightarrow \gamma$ transitions; growth of the abnormal γ and α phases with increase of the transition temperature and pressure during simultaneous decrease of the hysteresis and volume and thermal effects. It was established that the thermal and volume effects become zero at the critical point of the $\gamma \rightleftharpoons \alpha$ transition at ~480°K and 14.5 kbar. Volume anomalies without hysteresis were observed in the supercritical region. (tr-auth)

12026 MELTING MECHANISM IN BINARY ALLOYS. Kucherenko, E. S.; Salli, I. V. pp 89-93 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Fusion of systems with unlimited solubility in the solid and liquid state (Bi–Sb), of simple eutectic types (Pb–Sn, Bi–Sn, Bi–Cd, Pb–Sb), and of systems having complex phase diagrams (In–Sn, In–Pb, Pb–Bi, Sn–Sb, and Bi–Tl) were studied at different heating rates. An increase of the temperature for the beginning of fusion of solid solutions and the formation of small plateaus on the thermal curves during increase of the heating rate of solid solutions were observed. The limiting superheating temperature, corresponding to the equivalence temperature of the free energy of the solid and first portion of the liquid phases of the initial alloy concentrations, was reached initially with some high heating rates. Fusion of the eutectics occurs at the eutectic temperature in all intervals of the heating rates used (up to 30 thousand °/sec). Fusion of the eutectic "sandwich" of foils of pure metals occurs at the eutectic temperature in the case of low heating rates; at high rates only a kink was observed in the thermal curves at this temperature. Results are related to the diffusion and diffusionless mechanisms of fusion and are explained on the basis of the phase rule. (tr-auth)

12027 CONSTRUCTION OF THE SOLIDUS VOLUME IN THE Ti–V–Nb–W SYSTEM BY SIMPLEX-CENTROID METHODS. Levanov, V. I.; Sobolev, N. N.; Mikheev, V. S.; Elyutin, O. P. pp 107-111 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The solidus volume in parts of the Ti–V–Nb–W system, rich in Ti and limited by the 50% (V + Nb + W) cross section, was studied. On the basis of literature data and thermal analyses, it was concluded that the alloys of these regions of the four-component system are crystallized as continuous solid solutions. By means of a simplex-centroid method of planning experiments, a mathematical model of the solidus volume was constructed. This model makes it possible with sufficient precision to calculate the value of the temperature for the initiation of fusion of any soluble regions of the system. A graphic representation of the results of the mathematical simulation was done with a computer. The surfaces of the solidi were constructed and analyzed for a series of cross sections of the system and the solidus volume in the investigated part of the system was also analyzed. (tr-auth)

12028 PHASE DIAGRAM OF THE VANADIUM–SILICON SYSTEM. Kocherzhinskii, Yu. A.; Kulik, O. G.; Shishkin, E. A. pp 136-139 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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On the basis of microstructural, x-ray structural, and differential thermal analyses, the phase diagram of the V–Si system was constructed. Four phases were detected in the system and their fusion temperatures were determined as 1935 ± 20°C (congruent) for V_3Si, 2010 ± 20° (congruent) for V_5Si_3, 1670 ± 10° (incongruent) for V_6Si_4, and 1680 ± 10° (congruent) for VSi_2. The existence of five nonvariant equilibria was established: eutectic liquid $\rightleftharpoons$ V + V_3Si at 1800 ± 20°C and 13 at. % Si, liquid $\rightleftharpoons$ V_3Si + V_5Si_3 at 1890 ± 20° and 28 at. % Si, liquid $\rightleftharpoons$ V_6Si_4 + VSi_2 at 1640 ± 10° and 59 at. % Si, liquid $\rightleftharpoons$ VSi_2 + Si at 1375 ± 10° and 97 at. % Si, and peritectic liquid + V_6Si_3 $\rightleftharpoons$ V_5Si_4 at 1670 ± 10°. The limiting solubility of Si in V is less than 6 at. % at 1600°C. The region of homogeneity of V_3Si does not exceed 1 at. % Si at 1600°C. (tr-auth)

12029 TERNARY SYSTEM TANTALUM–NIOBIUM–RHENIUM. Tylkina, M. A.; Savitskii, E. M.; Alyushin, V. E. pp 140-143 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The cross section relating to the cast state of the alloys was constructed. Isosclines were carried out at 1700°. The region of the ternary solid solutions and its change with temperature was established. The presence of ternary χ and σ phases and the concentration intervals for their existence were determined. (tr-auth)

12030 PHASE DIAGRAM OF ZIRCONIUM-ENRICHED ALLOYS OF THE Zr–Fe AND Zr–Fe–Cu SYSTEMS. Malakhova, T. O. pp 144-147 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy

Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

The alloys were studied by microscopy and x-radiography. In the Zr–Fe system, a previously unknown compound with the composition Zr_3Fe was detected in alloys with large Zr concentrations in equilibrium with the compound Zr_2Fe and in alloys with smaller concentrations of Zr and with α or β-Zr solid solutions. The isothermal cross sections of the Zr corner of the phase diagram of the ternary system Zr–Fe–Cu (from Zr through the Zr_2Fe–Zr_2Cu cross section) were constructed at temperatures of 800 and 700°C. (tr-auth)

12031 PHYSICAL-CHEMICAL STUDY OF THE PARTIAL PHASE DIAGRAM OF ZrPd–Zr–ZrAg. Loboda, T. P.; Raevskaya, M. V.; Kovalkina, V. K.; Sokolova, I. G.; Pyatnitskii, V. N.; Sokolovskaya, E. M. pp 147-149 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The character of the location of the phase regions for annealed alloys of this system was established. The investigation showed that cross sections passing between the intermetallic compounds ZrPd and ZrAg and between Zr_2Pd and Zr_2Ag are quasi-binary in the solid state. (tr-auth)

12032 PHYSICAL-CHEMICAL STUDY OF THE TERNARY SYSTEM NIOBIUM–ZIRCONIUM–TIN. Soboleva, N. G.; Sokolovskaya, E. M.; Agafonov, V. N.; Fedorova, M. A. pp 149-152 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The isothermal cross section of the Nb–Zr–Sn system was constructed at 950°C. Equilibria between the Nb-based solid solutions and solid solutions based on the compounds Zr_5Sn_3, ArSn, and Nb_3Sn, between the two latter, and between β-Nb and Zr_4Sn were established. A new ternary intermetallic compound with the composition $Nb_2Zr_3Sn_5$ was detected. Equilibrium between this compound and solid solutions based on Nb_3Sn and ZrSn was established. Methods used were local x-ray spectral, x-ray phase, microstructural, and durometric analyses. (tr-auth)

12033 ALLOYS OF THE HAFNIUM–VANADIUM–CHROMIUM SYSTEM. Minaeva, S. A.; Budberg, P. B. pp 153-155 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

Alloys of the Hf–V–Cr system were studied by microstructural, x-ray, and high-temperature differential thermal analyses. The isothermal cross section of this system was constructed for 1400°C. The phase structure of the cross section between the intermetallides $HfCr_2$ and HfV_2 was studied at 1500, 1400, 1300, and 1200°C. It was established that the compound $HfCr_2$ has a structure of the $MgZn_2$ type in the cast state and after annealing at 1500, 1400, and 1350°C, structure of the $MgNi_2$ type at 1300°, and $MgCu_2$ type at 1200°C. (tr-auth)

12034 TERNARY SYSTEM V–Ti–Sn. Kornilov, I. I.; Matveeva, N. M.; Marchukova, L. V. pp 155-160 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The phase diagram of the V–Ti–Sn system was studied in the region bounded by the V–Ti side and by cross section through the compositions of the other two sides. In order to determine the phase boundaries, methods of microstructural, x-ray phase, local x-ray spectral, and differential thermal analyses were used. The diagram was represented in the form of the liquidus and solidus surfaces and in the form of isothermal cross section at 1200 and 600°. The cross sections are characterized by substantial regions of the β solid solutions, sharply contracting with decrease of the quenching temperature of the alloy. At 1540 and 1480°, four-phase nonvariant peritectic processes of the II and III classes occur. (tr-auth)

12035 POLYTHERMAL CROSS SECTION OF THE PHASE DIAGRAM OF THE Ti–Al–Zr–W SYSTEM. Oleinikova, S. V.; Nartova, T. T.; Kornilov, I. I. pp 160-163 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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Alloys of the four-component system with constant Al content (7 or 8 wt %) and constant W content (3 or 5 wt %) were studied during variation of the W content from 0 to 20 wt %. On the basis of microstructural, x-ray phase, and differential thermal analyses, the polythermal cross sections of the phase diagram of the four-component system were constructed. It was established that W even in quantities of about 1 wt % introduces into the alloy decomposition systems with formation of δ phase and a similar phase in the binary Ti–W system and ternary Ti–Al–W system. Addition of Zr does not lead to the appearance in the alloy structure of a new phase in comparison with alloys of the ternary Ti–Al–W system, does not decrease the existing conversion temperatures in the solid state, and displaces the boundary of the formation of the ordered α_2 phase to the side of lower Al concentrations. These facts must be considered during determination of the upper limits of the alloying of similar Ti alloys with Al. (tr-auth)

12036 PHASE DIAGRAM OF THE PLATINUM–ZIRCONIUM SYSTEM. Savitskii, E. M.; Polyakova, V. P.; Voronova, L. I. pp 164-166 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

The phase diagram of the Pt–Zr system was studied in the Zr content interval from 0 to 50 at. % Zr. A wide region of Pt-based solid solutions was detected and the existence of two chemical compounds Pt_3Zr and PtZr was confirmed. The maximum solubility of Zr in Pt is ~11 at. %. The compounds Pt_2Zr and PtZr are formed congruently. A eutectic interaction was observed between the compounds at 1855°C. (tr-auth)

12037 PHYSICAL-CHEMICAL STUDY OF THE INTERACTION OF RUTHENIUM WITH TITANIUM, ZIRCONIUM, AND HAFNIUM. Gulamova, D. D.; Raevskaya, M. V.; Sokolovskaya, E. M. pp 166-169 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The character of the phase equilibrium in the Ru–Ti–Zr, Ru–Ti–Hf, Ru–Zr–Hf systems in the homogenized state, and the state quenched from 1000°C was studied. The structure of the upper part of the phase diagram with Ru > 50 at. % was determined by the presence of or decomposition of the compounds Ru_2Zr and Ru_2Hf at a given temperature. In the Ru–Ti–Zr system, the wide region of the ternary solid solutions based on Ti and Zr was established. (tr-auth)

12038 PHASE EQUILIBRIUM IN THE RUTHENIUM–VANADIUM–HAFNIUM SYSTEM. Akhverdyan, M. M.; Burnasheva, V. V.; Raevskaya, M. V.; Sokolovskaya, E. M. pp 169-172 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The phase composition of cast, homogenized, and quenched alloys in the Ru–V–Hf system was studied by x-ray structural and metallographic analyses by measurement of the hardness and microhardness. The isothermal cross section of the phase diagram of this system was constructed at 900°C. A new ternary intermetallic compound $HfRu_{0.8\rightarrow0.3}V_{1.5\rightarrow1.7}$ was found pertaining to Laves phases with structural type $MgZn_2$ and a homogeneity range located along the isoconcentration of 33.3 at. % Hf from 8 to 19 at. % Ru. This compound is crystallized in a hexagonal lattice with the constants a = 5.18 Å, c = 8.40 Å, and c/a = 1.62. It is formed from the liquid state and has a wide range of homogeneity (up to 11 at. % Ru) and is stable at low temperatures. (tr-auth)

12039 TERNARY SYSTEMS Y–[Ni, Co, Mo, Ce]–Si AND Y–Ge–Si. Bodak, O. I.; Muratova, L. A.; Mokra, I. R.; Yarovets, V. I.; Sobolev, A. S.; Gladyshevskii, E. I. pp 182-186 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

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The phase equilibrium diagrams of the ternary Y–{Ni, Co}–Si systems were constructed at 800° in the region from 0 to 33.3 at. % Y and at 600° in the region from 33.3 to 100 at. % Y and for the Y–Mo–Si system at 800° and Y–{Ce, Ge}–Si at 600° in the complete concentration range. In the Y–{Ni, Co, Mo}–Si systems 12, 5, and 1 ternary compounds respectively were detected; in the Y–Ce–Si and Y–Ge–Si systems continuous and narrow solid solutions of large dimensions were formed. A comparison of the systems {Y, Ce}–M–Si, where M is a transition metal, showed that both the differences in atomic dimensions and their electronic structure affect the quantity of compound formed. In the Y–Ce–Si and Y–Ge–Si systems the proximity of the crystallochemical properties of two components (Y, Ce and Ge, Si) excludes the possibility of the existence of ternary compounds. (tr-auth)

12040 TERNARY SYSTEMS {Sm, Tm, Lu}–{Gd, Y, Tb, Dy, Ho, Er, Tm, Lu, Sc}–Al IN THE REGION OF 0 TO 25 AT. % RARE EARTH METAL. Zalutskaya, O. I.; Cherkaskin, E. E.; Zalutskii, I. I. pp 186–193 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

Al-rich alloys of 24 ternary systems R′–R″–Al (where R′ and R″ are rare earth metals) were studied by x-ray structural analysis. The isothermal cross sections of the phase diagrams of these systems were constructed at 500°C. On the quasi-binary cross section $R'Al_3$–$R''Al_3$, phases were formed which appear to be solid solutions based on binary trialuminides of the rare earth metals or the ternary compounds $R'_xR''_{1-x}Al_3$. Relations between the phase equilibrium diagrams of the Al corner of the R′–R″–Al ternary system were established by the character of the structural transformation in the quasi-binary systems $R'Al_3$–$R''Al_3$ and by the crystalline structure of $R'Al_3$ and $R''Al_3$. (tr-auth)

12041 ALLOYS OF CHROMIUM WITH SAMARIUM, THULIUM, AND LUTETIUM. Svechnikov, V. N.; Kozenko, G. F.; Ivanchenko, V. G. pp 194–198 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

Binary alloys of Cr with Sm, Tm, and Lu were studied by metallographic, x-ray structural, and differential thermal analyses. Alloys were prepared in arc furnaces from compact metals. Phase diagrams were constructed over the complete temperature and concentration ranges. Cr forms a limited series of solid solutions with Sm, Tm, and Lu. The limited miscibility of Cr with Sm and Tm in the liquid state was established. (tr-auth)

12042 PHASE DIAGRAMS OF THE Ga–Na, Ga–K, In–K, AND In–Rb SYSTEMS. Yatsenko, S. P.; Chuntonov, K. A.; Bushmanov, V. D.; Dieva, E. N. pp 198–201 of Struktura faz, Fazovye Prevrashcheniya i Diagrammy Sostoyaniya Metallicheskikh Sistem. Ivanov, O. S. (ed.). Moscow; Izdatel'stvo Nauka (1974). (In Russian).

From sixth all union conference on phase structure, phase transformations, and phase diagrams of metallic systems; Moscow, USSR (18 Sep 1972). See CONF-7209120-.

The systems were studied by differential thermal analysis, x-radiography, and solubility measurements. In the Ga–Na and In–K systems, the impossibility of the existence of a region of stratification in the liquid state was shown. The composition of the peritectic phase (AB_3 instead of AB_4) was made more precise. In the Ga–K system the limits of the region of stratification in the liquid state were determined. It was established that compounds have the formulas KGa_3 and KGa_2. In the In–Rb system a new phase Rb_2In_3 was detected and the compositions of previously known compounds were made more precise: the peritectic compounds have the composition $RbIn_2$ instead of $RbIn_4$ and the congruently melting compounds have the composition Rb_4In_3 instead of Rb_3In_5. (tr-auth)

12043 THERMODYNAMIC PROPERTIES OF LIQUID URANIUM–INDIUM ALLOYS. Lebedev, V. A.; Seregin, V. M.; Poyarkov, A. M.; Nichkov, I. F.; Raspopin, S. P. (Urals Polytechnic Inst., Sverdlovsk, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 48: No. 3, 317-319(Mar 1974).

Translated from Zh. Fiz. Khim.; 48: No. 3, 542-545(Mar 1974).

The thermodynamic properties of uranium solutions in liquid indium (of the compound UIn_3) have been investigated by an emf method in the range 723–1123°K and the limits of the solubility of uranium in fused indium have been determined. The characteristics of uranium–indium alloys are close to those of uranium–lead alloys. (auth)

12044 MOESSBAUER EFFECT MEASUREMENTS IN THE DYSPROSIUM–SILICON AND DYSPROSIUM–GALLIUM EQUIATOMIC COMPOUNDS. Iraldi, R.; Nguyen, V. N.; Rossat-Mignod, J.; Tcheou, F. (CEN, Grenoble, France). Solid State Commun.; 15: No. 9, 1543-1546(1 Nov 1974).

Mössbauer effect measurements were performed in dysprosium–silicon and dysprosium–gallium equiatomic compounds. The experimental results were compared with crystal field calculations based on a point charge model. The calculated second order crystal field parameters were found to be predominant. The magnetic moment of the ground state is highly anisotropic and its high value (9.8 μ_B) is in good agreement with the observed magnetic hyperfine field which is similar for both the pure and the diluted compounds. The same magnitude of the quadrupolar interactions in these compounds as well as in the Dy metal may be attributed to the predominant contribution of the 4f electrons. (auth)

12045 EXTRAORDINARY HALL EFFECT OF THE RARE EARTH METALS. Fert, A. (Paris Univ., Orsay, France). J. Phys. (Paris); 35: No. 7, L107-L110(Jul 1974).

Assuming a Kondo–Giovannini type interaction between conduction electrons and rare-earth ions the contribution of the side-jump effect to the extraordinary Hall resistivity of the rare-earths is calculated. This contribution is fairly large and explains the experimental Hall resistivity of terbium and dysprosium using a combination of skew scattering and side-jump terms. The problem of scattering with side-jump by isolated rare-earth impurities is also considered. (FR)

12046 ANISOTROPIES IN MICROSTRUCTURES AND CRITICAL CURRENT DENSITIES IN SUPERCONDUCTING V_3Ga TAPES. Tanaka, Y.; Tachikawa, K. (National Research Inst. for Metals, Tokyo). J. Less-Common Metals; 37: 177-180(1974).

These anisotropies are described. Transmission electron microscopy results indicate that the only defects found in appreciable numbers in the V_3Ga tapes are at grain boundaries; these boundaries are the most important flux pinning centers and the critical current density is strongly dependent on the grain size of V_3Ga. (JRD)

12047 PROPERTIES OF $PrPb_3$ IN RELATION TO OTHER $L1_2$ PHASES OF Pr. Bucher, E.; Andres, K.; Gossard, A. C.; Maita, J. P. (Bell Telephone Labs., Murray Hill, NJ). pp 322-326 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

It is shown that the low-temperature electronic properties of $PrPb_3$ can be interpreted consistently if the Pb ligands carry a negative effective point charge (non-Kramers, nonmagnetic, ground-state doublet Γ_3). Considerable antiferromagnetic exchange coupling exists. The magnetic properties and crystal-field splittings of all PrX_3 compounds are considered together; results show that the change can be correlated with the electronegativity of the ligands. (DLC)

12048 LOW-TEMPERATURE RESISTANCE ANOMALIES IN IRON-DOPED V–Cr ALLOYS. Rusby, R. (Imperial Coll., London); Coles, B. R. pp 423-426 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Resistivity vs temperature graphs show that the appearance of Kondo minima is determined by both the Cr content (60 to 90%) and the Fe probe content (0 to 8 at.%). It is shown that some of the effects are due to local spin fluctuations. (DLC)

12049 NUCLEAR ORIENTATION EXPERIMENTS ON DILUTE $Au_{1-x}Ag_xYb$ ALLOYS. Flouquet, J.; Sanchez, J. (Paris Univ., Orsay, France). pp 448-450 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

These experiments were performed in order to make magnetization measurements directly on the Yb impurity. The alloys were obtained by Yb ion implantation at 100 keV; they were then cooled to near 0.015°K and the anisotropy of the Yb 283-keV γ rays measured as functions of applied field (100 to 5000 Oe) and temperature. Results for Au–Yb ($x = 0$) are consistent with a Γ_7 fundamental state of the Yb impurity; saturation of anisotropy in 5 kOe rules out a Kondo temperature > 0.1°K and indicates

weak coupling. However, for x > 0.1, resonant coupling was found, contradicting Allali (Sol. St. Comm. 7: 1241 (1969) and agreeing with the EPR experiments of Tao (Phys. Rev. B 3:45 (1971)). (DLC)

12050 PROPERTIES OF DILUTE TRANSITION-BASED ALLOYS WITH ACTINIDE IMPURITIES: EVIDENCE OF LOCALIZED MAGNETISM FOR NEPTUNIUM AND PLUTONIUM. Galleani d'Agliano, E.; Gomes, A. A.; Jullien, R.; Coqblin, B. (Paris Univ., Orsay, France). pp 459-464 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

A simple model using a 6d and a 5f virtual bound state with large d-f hybridization, is described. If the hybridization is reduced, the actinides can become magnetic. Both Np and Pu are magnetic in transition metal-based alloys, while Np and Pu pure metals are not magnetic. Both nonmagnetic and ferromagnetic transition-metal hosts are considered. (DLC)

12051 LINEAR VARIATION OF THE IMPURITY RESISTIVITY IN AlMn, AlCr, ZnFe, AND OTHER DILUTE ALLOYS. Babic, E. (Univ. of Zagreb); Rizzuto, C. pp 484-487 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The low-temperature impurity resistivity of Al-Mn, Au-V, Cu-Fe, Pt-Cr, Y-Ce, Zn-Fe, and Zn-Cr follows the equation $\rho(T) = \rho(0)[1-T/(\theta_R)^2]$. $\rho(0)$ and θ_R values are tabulated for the alloys. Results suggest that the overall shape of the resistivity curve does not change much between nonmagnetic and magnetic systems. (DLC)

12052 HALL EFFECT INDUCED BY SKEW SCATTERING IN LaCe. Fert, A.; Janoul, O. (Paris Univ., Orsay, France). pp 488-490 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The Hall resistivity was measured for a La-3.4% Ce alloy at 2 to 77°K as a function of field. The dependence on H and T suggests that the extraordinary Hall resistivity is due to skew scattering by the Ce impurities. (DLC)

12053 KONDO EFFECT IN YCe UNDER PRESSURE. Gey, W. (Univ., Karlsruhe, Ger.); Dietrich, M.; Umlauf, E. pp 491-494 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The pressure dependence of the resistance anomaly of Y-1 at.% Ce was studied at 0 to 40 kbar. The depth of the resistivity minimum decreases with pressure; the magnetic part show that this is due to an increase of the Kondo temperature, from 17°K at 0 kbar to 110°K at 30 kbar. No magnetic transition was observed. (DLC)

12054 LOW-TEMPERATURE MAGNETIC PROPERTIES OF Zn-Mn SINGLE CRYSTALS. Li, P. L.; Muir, W. B. (McGill Univ., Montreal). pp 495-499 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Results are presented of magnetic anisotropy measurements from 2 to 300°K on Zn-Mn alloys having Mn contents up to 475 ppM. The sign of the anisotropy changes at ~270 ppM. (DLC)

12055 INFLUENCE OF LATTICE DEFECTS ON THE KONDO RESISTANCE ANOMALY IN DILUTE ZnMn THIN-FILM ALLOYS. Falke, H. P.; Jablonski, H. P.; Wassermann, E. F. (Physikalisches Inst., Aachen). pp 500-502 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The electrical resistivity of Zn-Mn (200 to 3000 ppM Mn) thin films was investigated at 0.35 to 350°K. Resistivity vs temperature curves are given for 400-Å films with 300 and 3000 ppM Mn after stepwise annealing at 15 to 350°K recooling. The resistivity decreases on annealing because of healing of lattice defects. The Kondo slope increases with annealing temperature. Flattening of the curves is attributed to strengthening of the Rudermann-Kittel interaction between magnetic impurities. (DLC)

12056 EVIDENCE FOR IMPURITY INTERACTIONS FROM LOW-TEMPERATURE SUSCEPTIBILITY MEASUREMENTS ON DILUTE ZnMn ALLOYS. Schlabitz, W. (Univ., Cologne); Wassermann, E. F.; Falke, H. P. pp 503-505 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The inverse susceptibility $1/\Delta x = 1/(x_{alloy} - x_m)$ vs temperature for cold-rolled strips with Mn contents 12 to 275 ppM Mn follows a Curie-Weiss law between 2.7 and 50°K, with a concentration-independent paramagnetic Curie temperature of -1°K. The Curie constants are almost directly proportional to the Mn content, except for the lower Mn contents; annealing increases the effective moment for these low contents. It is concluded that impurity-impurity interactions do influence all Kondo anomalies down to 0.5°K if the Mn content >20 ppM. (DLC)

12057 LOW-TEMPERATURE ELECTRICAL RESISTIVITY OF PALLADIUM-CERIUM ALLOYS. Mydosh, J. A. (Kernforschungsanlage, Juelich, Ger.). pp 506-509 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

In order to understand the nature of Ce in Pd, accurate (1 part in 10,000) measurements were made of the electric conductivity of Pd-0.6 at.% Ce, Pd-1.8 at.% Ce, and Pd-5.7 at.% Ce at 1.5 to 100°K. Weak minima were observed in the 1-10°K region, but it is concluded that the Ce impurities are in the nonmagnetic (4+ valence) state. (DLC)

12058 SPECIFIC HEAT ANOMALIES OF PtCo ALLOYS AT VERY LOW TEMPERATURES. Costa-Ribeiro, P.; Saint-Paul, M.; Thoulouze, D.; Tournier, R. (CNRS, Grenoble, France). pp 520-524 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Measurements were made on samples containing 0.1 to 2.6 at.% Co at 0.02 to 4°K. Results show the existence of two different types of magnetic behavior: that of the "isolated" impurities, which present a one-impurity effect anomaly near their critical temperature $T_k \approx 1.6$°K; and the residual magnetism of pairs of cobalt impurities which order much below T_k, as shown by their nuclear Schottky anomaly, and carry their maximum moment. Those remaining have their local susceptibility enhanced by effects of density of states and carry induced moments. (DLC)

12059 ANOMALOUS LOW-TEMPERATURE SPECIFIC HEAT OF DILUTE FERROMAGNETIC ALLOYS. Heritier, M.; Lederer, P. (Paris Univ., Orsay, France). pp 529-533 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The case of a ferromagnetic host containing dilute isoelectronic impurities of nearly ferromagnetic metal, illustrated by Ni-Pd alloys, is examined. Ring and ladder diagrams and Hartree-Fock correction of metal propagation are used to calculate the magnon scattering, which would lead to a $T^{1/2}$ term in the specific heat. Conditions for observing this are discussed, and it is concluded that a Ni-500 ppM Pd alloy should exhibit a $T^{1/2}$ law in the specific heat between 1 and 15°K. (DLC)

12060 ANOMALOUS BEHAVIOR OF THE KONDO SUPERCONDUCTOR $(La_{1-x}Ce_x)Al_2$. Minnigerode, G. V.; Armbruester, H.; Riblet, G.; Steglich, F.; Winzer, K. (Univ. of Cologne). pp 567-573 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The vanishing of superconductivity below a second transition temperature has been observed in (La, Ce) Al_2 alloys due to the Kondo effect. The transitions back into the normal state were measured for the first time, both by a low-frequency mutual inductance technique and by resistivity measurements down to 0.030°K. No indication of the reappearance of superconductivity at a third transition at ultra low temperatures has been found. The strange behavior of the upper critical magnetic field and the specific heat for these alloys has been verified experimentally. (6 fig) (auth)

12061 MAGNETIC IMPURITIES IN SUPERCONDUCTING La_3Al ALLOYS. Aoi, T.; Masuda, Y. (Nagoya Univ., Japan). pp 574-578 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The superconducting T_c for solid solutions of Ce in La_3Al was measured as a function of impurity (Ce) content by means of specific heat measurements. Results are compared with $La_{3-x}Gd_xAl$ data, Abrikosov–Gorkov theory, and Mueller-Hartmann and Zittartz theory. Upper critical fields were also measured and compared with these calculated by Maki. (DLC)

12062 Ce IMPURITIES IN Th-BASED SUPERCONDUCTING HOSTS. Huber, J. G.; Maple, M. B. (Univ. of California, San Diego, La Jolla). pp 579-584 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The depression of superconducting T_c by nonmagnetic Ce impurities was studied in alloys of Th with Zr, Hf, Sc, Y, or Lu. It is shown how the Ce effect varies with average number of valence electrons per host atom, host lattice parameter, and pressure. Fits to the equation $T_c = T_{co}e^{An/(1-Dn)}$ are also given, and the parameter A is evaluated. Relations between log A and $\Delta\alpha$ (difference in host fcc lattice parameter from pure Th value) and pressure are linear. (DLC)

12063 HEAT CAPACITY OF ThU ALLOYS AT LOW TEMPERATURES. Luengo, C. A. (Comision Nacional de Energia Atomica, Bariloche, Argentina); Cotignola, J. M.; Sereni, J.; Sweedler, A. R.; Maple, M. B. pp 585-589 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Specific heat measurements between 0.5 and 5°K were undertaken in order to study the magnetic character of U impurities in a Th matrix. The U content was varied from 0 to 2.1 at.%. The specific heat jumps at T_c follow closely the BCS law of corresponding states, indicating that the T_c depression by U impurity is due to pair-weakening rather than pair-breaking interactions. (DLC)

12064 SUPERCONDUCTING CRITICAL FIELD CURVES FOR Th–U. Watson, H. L.; Peterson, D. T.; Finnemore, D. K. (Ames Lab., IA). pp 590-592 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The curves for 0, 0.05, and 0.10 at.% U show marked deviations from the Abrikosov–Gorkov theory as would be expected if the U impurity shows localized spin fluctuations. The effective spin scattering rate for the U impurity has a linear rather than quadratic temperature dependence at 0.3 to 1.1°K, indicating that the broadening of the impurity U state is comparable to the Coulomb repulsion. The residual spin scattering as the temperature approaches zero implies that U impurities in Th have a small moment even in the limit of T = 0. (DLC)

12065 EFFECTS OF SOME 3d AND 4d SOLUTES ON THE SUPERCONDUCTIVITY OF TECHNETIUM. Koch, C. C.; Gardner, W. E.; Mortimer, M. J. (Oak Ridge National Lab., TN). pp 595-600 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

An experimental study was made of changes in T_c, magnetic susceptibility, and electric resistivity of Tc with concentrations of up to 5 at.% Cr, Fe, Co, Ni, or Ru. T_c and susceptibility are plotted vs average group number in the periodic table. Results show no localized magnetic moments on the solute atoms, or any Kondo effect. The use of the bond model to explain the data is discussed, but Fe decreases T_c and increases susceptibility much more rapidly; thus, there must be additional pair-destroying or pair-weakening interactions present. (DLC)

12066 DIRECT EVIDENCE FOR THE COEXISTENCE OF SUPERCONDUCTIVITY AND FERROMAGNETISM. Taylor, R. D.; Decker, W. R.; Erickson, D. J.; Giorgi, A. L.; Matthias, B. T.; Olsen, C. E.; Szklarz, E. G. (Los Alamos Scientific Lab., NM). pp 605-609 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The superconducting transition temperature and the ferromagnetic ordering temperature crosses at 4°K and $X \cong 0.125$ in $Ce_{1-x}Gd_xRu_2$. Moessbauer effect and ^{57}Fe were used to detect magnetic order in these compounds with $X \approx 0.115$, 0.130, and 0.145. Results show the existence of ferromagnetism in the neighborhood of the critical concentration X and at temperatures well below T_c. (DLC)

12067 LOW-TEMPERATURE HEAT CAPACITY OF α- AND B-CERIUM. Conway, M. M.; Phillips, N. E. (Univ. of California, Berkeley). pp 629-632 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Heat capacities of mixed-phase ($\alpha-\beta$) Ce samples were measured, using the antiferromagnetic ordering anomaly (12.5°K) β-Ce as a measure of the composition. Thermal cycling was used to vary the mole fraction of the β-phase from 0.3 to 0.8, and the extrapolated capacity for the α-phase varies smoothly through 12.5°K. At low temperatures, the heat capacity of the β-phase is $C = 54T + 5.6\ T^3$ mJ/mole-°K. β-Ce has a dhcp structure, with half its atoms in cubic and the other in hexagonal; the cubic sites are the ones which order at 12.5°K. (DLC)

12068 SUPERCONDUCTING CRITICAL CURRENTS OF SMALL COILS OF MULTIFILAMENTARY V_3Ga WIRE UNDER PULSED CURRENT EXCITATION. Itoh, K.; Tachikawa, K. (National Research Institute for Metals, 2–3–12, Nakameguro, Meguro–ku, Tokyo, Japan). Appl. Phys. Lett. 26: No. 2, 67-68 (15 Jan 1975).

In this study, the critical currents of small coils wound by multifilamentary wire of *A*–15–type superconducting V_3Ga have been measured in large exciting speeds. The critical currents of the coils do not degrade up to exciting speeds of over 200 kOe/sec. The results are compared with those of similar coils wound by multifilamentary Nb–Ti wire. (auth)

12069 AUGMENTED–PLANE–WAVE CALCULATION OF INDIRECT–EXCHANGE MATRIX ELEMENTS FOR GADOLINIUM. Harmon, B.N. (Ames Laboratory–U.S.AEC and Department of Physics, Iowa State University, Ames, Iowa 50010); Freeman, A.J. Phys. Rev. B 10: No. 12, 4849-4855 (15 Dec 1974).

The exchange matrix elements between a local 4f moment and the conduction electrons (Ruderman–Kittel–Kasuya–Yosida exchange) have been calculated for paramagnetic gadolinium metal using nonrelativistic augmented–plane–wave wave functions. The magnitude of the matrix elements is found to be largest for d–like conduction electrons and is quite sensitive to their angular distribution. Because of band crossings, which cause rapid changes in wave–function character, the matrix elements cannot be well described as slowly varying functions of $\vec{q} = \vec{k}' - \vec{k}$. (auth)

12070 FERMI SURFACE AND ELECTRONIC DENSITY OF STATES OF MOLYBDENUM. Koelling, D.D.; Mueller, F.M.; Arko, A.J. (Argonne National Laboratory, Argonne, Illinois 60439); Ketterson, J.B. Phys. Rev. B 10: No. 12, 4889-4896 (15 Dec 1974).

The electronic energy–band structure of molybdenum has been calculated by means of the relativistic augmented–plane–wave method applied to the overlapping charge–density model. Full Slater exchange was employed. Calculations of extremal calipers, extremal cross–sectional areas, and cyclotron effective masses for the magnetic field along symmetry directions are reported and compared with experimental data where available. Comparison of the theoretical and experimental cyclotron–mass data indicate an anisotropic electron–phonon mass enhancement of approximately 0.33, which is smaller than the McMillan value of 0.41. (auth)

12071 THE ORIGIN OF INTERNAL STRESS IN LOW–VOLTAGE SPUTTERED TUNGSTEN FILMS. Sun, R.C.; Tisone, T.C.; Cruzan, P.D. (Bell Telephone Laboratories, Allentown, Pennsylvania 18103). J. Appl. Phys. 46: No. 1, 112-117 (Jan 1975).

The internal stress can be of importance in the tungsten metallization process used for the fabrication of large–scale integrated circuits. The present work is an extension of an earlier study on the dependence of the stress in low–voltage triode sputtered tungsten films upon deposition conditions and substrate materials. As a function of film thickness, the stress was found to decrease with increasing thickness at various substrate temperatures. The effect of higher substrate temperatures is just to change from large compressive stress to smaller compressive stress and finally into tension. For example, the stress in a 5000–Å film decreases from 1.6×10^{10} dyn/cm² in compression to 5×10^{9} dyn/cm² in tension as substrate temperature increases from 370

to 850 °C. Generally, no gross difference was found for films deposited on SiO_2, Al_2O_3, or Si_3N_4 at higher substrate temperatures. As a function of deposition rate, the stress can be described in three regions. The stress was found to be small and relatively constant in the low-deposition-rate region. However, as the deposition rate increased to the transition region, a sharp stress increase was found. Finally, above a critical deposition rate, the large internal stress remains constant again. By measuring the stress and characterizing the microstructure of the film, it is concluded that the grain size is the dominant factor determining the stress. These experimental results are discussed in light of the grain boundary relaxation model of Finegan and Hoffman and annealing of disorder proposed by Klokholm and Berry. (auth)

12072 A DYNAMIC MODEL FOR FLUX JUMPS IN TYPE-II SUPERCONDUCTORS. Bussière, J.F. (Brookhaven National Laboratory, Upton, New York 11973); LeBlanc, M.A.R. J. Appl. Phys. 46: No. 1, 406-415 (Jan 1975).

The behavior of flux jumps in hard type-II superconductors can in principle be described by solutions of coupled thermal and magnetic diffusion equations. A simple magnetic diffusion equation for hard type-II superconductors based on the flux-flow concept is proposed and numerical solutions are presented for physical parameters corresponding to a sample of NbTi. Although simplifying assumptions, such as adiabatic conditions and the J_c independence of magnetic field, are made, both the threshold field of stability and the rate of flux collapse are found to agree at least qualitatively with epxerimental values obtained in a NbTi rod. Calculated sequences of magnetic field, temperature, and power density profiles occurring during flux jumps are presented. (auth)

12073 TEMPERATURE DEPENDENCE OF AC LOSS IN TYPE-II SUPERCONDUCTORS. McConnell, R.D.; Critchlow, P.R. (Institut de Recherche de l'Hydro-Québec, C. P. 1000, Varennes, Quebec, Canada). J. Appl. Phys. 46: No. 1, 426-429 (Jan 1975).

Superconducting ac losses have been measured between 4 and 8.5 K for two single-filament NbTi wires and one multifilamentary Nb_3Sn wire carrying ac current. The results demonstrate that the temperature dependence of the critical current density is the predominant factor for the NbTi samples. A temperature-dependent screening current and critical current are needed to explain the Nb_3Sn behavior. (auth)

12074 SUBLATTICE MAGNETIZATION OF DYSPROSIUM NEAR THE NEEL POINT. Loh, E.; Chien, C. L.; Walker, J. C. (Johns Hopkins Univ., Baltimore, Md. (USA)). Phys. Lett., A; 49: No. 5, 357-358(7 Oct 1974).

The sublattice magnetization of a single crystal of dysprosium metal near the magnetic critical point was determined from Mossbauer effect measurements of the hyperfine structure. No relaxation effects were observed and the critical exponent β was measured to be 0.335 ± 0.010. (auth)

12075 APPARENT DEPENDENCE OF α-PARTICLE INDUCED L-SUBSHELL IONIZATION ON OUTER-ELECTRON CONFIGURATIONS. Chang, C. N.; Morgan, J. F.; Blatt, S. L. (Ohio State Univ., Columbus (USA). Dept. of Physics). Phys. Lett., A; 49: No. 5, 365-366(7 Oct 1974).

Measurements are reported for positive-ion induced L-subshell ionization cross section ratios. For α-particle projectiles, the L_{III}/L_{II} low-energy behavior for Au and Pt differs dramatically from that for Ta and Bi. Correlation with the outer electron configurations of these atoms is suggested. (auth)

12076 NORMAL STATE ELECTRICAL RESISTANCE BEHAVIOR AND SUPERCONDUCTING TRANSITION TEMPERATURES IN (La,Ce) Ru_2 ALLOYS. Lawson, A. C. (California Univ., La Jolla, San Diego (USA). Inst. of Pure and Applied Physical Sciences); Engel, U.; Baberschke, K. (Freie Univ. Berlin (F. R. Germany)). Phys. Lett., A; 49: No. 5, 373-374 (7 Oct 1974).

It has been shown recently that many superconducting transition metal compounds show marked negative curvature in their resistance-temperature curves. A correlation between the shape of electrical resistance-temperature curves and the superconducting transition temperature of (La,Ce)Ru_2 alloys has been established. (auth)

12077 INTERACTION OF POSITRONS WITH NIOBIUM ATOM CHAINS IN Nb_3Al. Sedov, V. L.; Krasnopyerov, E. P.; Alekseevsky, N. E. (Moskovskij Gosudarstvennyj Univ. (USSR). Fizicheskij Fakul'tet). Phys. Lett., A; 49: No. 5, 405-406 (7 Oct 1974).

The angular correlation of annihilation in Nb_3Al is investigated. The results indicate that positrons may be trapped by deformed sections of Nb atomic chains. It is concluded that the Fermi level for d-electrons of such chains is located near the boundary of the Brillouin zone. (auth)

Radiation Effects

Refer also to abstracts 11319, 12211, and 12741.

12078 (AD-781978) DYNAMIC RESPONSE OF ALUMINUM TO PULSED ENERGY DEPOSITION IN THE MELT-DOMINATED REGIME. Oswald, R. B. Jr.; McLean, F. B.; Schallhorn, D. R.; Oldham, T. R. (Harry Diamond Labs., Washington, D. C. (USA)). Jul 1973. 39p. (HDL-TR-1624). NTIS $3.25.

The results of an experimental study of the material dynamic response of aluminum exposed to a high-fluence, low-energy, pulsed electron beam are presented. The experimental results are compared with calculations based on two equilibrium equation of state (EOS) models for metals in the melt regime. The first model is the simple Mie-Gruneisen (M-G) scheme for solids extrapolated into the liquid phase. The second model (the Gray EOS) is a three-phase EOS which provides a more detailed and thermodynamically complete description of metals in the melt region. After the onset of melting the M-G theory differs appreciably from experiment, whereas the Gray EOS provides good agreement. The results indicate that the P-V-T relationship during the melting process can be described by an equilibrium — but thermodynamically consistent — EOS model. (GRA)

12079 (AD-782516) FATIGUE RESISTANCE OF TYPE 348 STAINLESS STEEL UNDER SIMULATED WATER REACTOR CONDITIONS. Final Report. Smith, H. H.; Shahinian, P. (Naval Research Lab., Washington, D. C. (USA)). 26 Jun 1974. 16p. (NRL-7770). NTIS $3.00.

The effects of neutron irradiation and high-temperature water-vapor environment on the fatigue behavior of type 348 stainless steel were investigated. The tests were conducted in reverse bending at a constant amplitude of vibration in dry air, in water vapor, and in vacuum. Tests in water vapor were designed to simulate water-cooled reactor environments. Notched specimens were cycled at resonance, and crack-growth rates were determined by a method that relates changes in the frequency of vibration to crack growth. The general improvement in fatigue life for the irradiated condition was attributed mainly to decreased crack-growth rates. The fatigue life of this steel, when unirradiated, was longest in vacuum, was less in water vapor, and was least in air. The results of this study indicate that the fatigue performance of reactor components made of type 348 stainless steel should not be adversely affected by the environment found in water-cooled reactors. (GRA)

12080 (CEA-CONF-2633) DECHANNELING OF FAST PARTICLES BY LATTICE DEFECTS. Quere, Y. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). [nd]. 10p. (CONF-740104-23). Dep. NTIS (U. S. Sales Only) $4.00.

From surface effects in controlled thermonuclear fusion devices and reactors meeting; Argonne, Illinois, USA (10 Jan 1974).

Channeling is one among the numerous phenomena occuring at the surface of any device irradiated by fast particles. Dechanneling by any type of lattice defect — and in particular by the defects created by the irradiation itself — may play a significant role in such phenomena as sputtering, blistering. It is shown that dechanneling can be due to an obstruction effect (typical example: stacking fault), or to the deformation of the lattice (typical example: dislocations) or to both effects occuring simultaneously (typical examples: defect-clusters, and Guinier-Preston (G.P.) zones). Calculations of the corresponding dechanneling cross sections are presented. Experimental evidence of dechanneling are described for such defects as grain — (or twin-) boundaries, stacking faults, dislocations, interstitial atoms, radiation induced defects, gas bubbles, G.P. zones, and order antiphase boundaries. The experimental values are in agreement with the theoretical values. For example the dechanneling width of a straight dislocation, in aluminum, for α particles (5 MeV) channeled along {111} planes, is found equal to 140 ± 40 Å, whereas 175 Å is the calculated value. (auth)

12081 (COO-2186-8, pp 43-44) RADIATION DAMAGE IN SOLIDS WITH LOW MELTING POINTS. Huntington, H. B.; Salinger, G. L.; Borton, D. N.; Mardiguian, A. (Rensselaer Polytechnic Inst., Troy, NY). Jun 1973.

In Nuclear Accelerator Laboratory annual report.

12082 (KAPL-M-7357) DESCRIPTION OF THE COMPUTER PROGRAM "DYNAM" SIMULATING LOW-ENERGY RADIATION DAMAGE EVENTS IN HCP ZIRCONIUM. Brudnoy, D. M. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). 18 Jan 1974. Contract W-31-109-eng-52. 39p. Dep. NTIS $5.00.

The physical assumptions and general features of the DYNAM code are presented. A general description of methods used in a simulation study is included along with the basic geometric information on hcp lattices and discussions of fundamental types

of particle interactions. Damage regions established by DYNAM are described along with boundary conditions used in the program. Energy distribution in the lattice during a damage event is also described. (JRD)

12083 (RD/B/N-2846) STABILITY OF UAl_2 PRECIPITATES UNDER NEUTRON IRRADIATION. Baker, C. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

A study is made of the irradiation stability of UAl_2 precipitates in adjusted uranium fuel bars. It is found that the precipitates coarsen under irradiation but at an enhanced rate compared with thermal annealing. The precipitates grow by dislocation pipe diffusion. Irradiation of uranium results in anisotropic growth of the crystal grains and the consequent internal stresses generate high dislocation densities. This increase in dislocation density is a major contributory factor to the enhanced coarsening rate. (auth)

12084 (SAND-74-5424) IMPLANTATION INTO METALS: COMPOUND FORMATION AND DAMAGE PRODUCTION. Myers, S. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 16p. (CONF-741040-5). Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

Ion implantation in metals can be used in two ways: (1) for the modification of composition in the near-surface region of a solid, where it can produce states not achievable by equilibrium means; (2) for the controlled introduction of damage. Qualitative differences from implantation in semiconductors include the greater degree of annealing of defects in metals and the much higher fluence levels which are of interest. Basic research on the implantation process in metals generally is concerned with one or more of three phenomena: the lattice location occupied by implanted ions when the temperature is low enough to prevent agglomeration; characterization of precipitation processes at higher temperatures; and effects produced by implantation damage. Experiments directed toward applications show great potential for fabrication of superconductors, modification of the corrosion and mechanical properties of surfaces, studies of metallic diffusion and alloying, and simulation of reactor radiation effects. (25 references, 4 fig) (auth)

12085 MECHANICAL PROPERTIES OF SINGLE CRYSTALS OF α-URANIUM IRRADIATED UNDER CONDITIONS OF FREE AND CONSTRAINED RADIATION GROWTH. Golovchenko, Yu. M.; Butra, F. P.; Portnov, V. F.; Burmistrov, V. N.; Korobeinikov, I. A.; Fufaeva, O. L. At. Energ. (USSR); 37: No. 4, 316-321 (Oct 1974). (In Russian).

Mechanical properties of single crystals of α-uranium oriented in a direction close to the [010] crystallographic direction were investigated. Single crystals of α-uranium were irradiated under conditions of free and mechanically constrained radiation growth with doses of $2.4 \cdot 10^{20}$ n/cm^2. It has been shown that mechanical properties of crystals irradiated under constrained and free growth conditions differ appreciably. The annealing of crystals irradiated under either of the above conditions results in some recovery of plasticity. An explanation of the behavior of constrained and freely growing crystals during irradiation and annealing is given. It is shown that irradiation leads to locking the (010)-[100] slip system and twinning the (172), (176) and (112) planes and impedes slightly (130)-[310] twinning. The force developed by uranium crystals of chosen operations growing during irradiation has been determined and it is found that this force is independent of the irradiation dose. The conclusion is drawn that irradiation growth of uranium may be reduced by mechanical constraint. (5 figures, 2 tables, 11 references.) (auth)

12086 INVESTIGATION OF FRENKEL DEFECTS IN ELECTRON IRRADIATED COPPER BY HUANG SCATTERING OF X RAYS. I. Results for Single Interstitials. Ehrhart, P.; Schlagheck, U. (Kernforschungsanlage, Juelich, Ger.). J. Phys., F (London); 4: No. 10, 1575-1588 (Oct 1974).

The diffuse scattering of x rays ($CuK_{\alpha 1}$) and the change of the electrical resistivity were investigated for single crystals of copper after low temperature electron irradiation (defect concentrations between 3 and 6×10^{-4}). The x ray measurements were made near the (200), (400), and (220) Bragg reflections in directions parallel and perpendicular to the scattering vector. The data taken immediately after the irradiation showed all the characteristic features predicted by the theory for scattering from point defects with weak displacement fields (Huang scattering). The results are: (1) the long range part of the displacement field of the interstitial has slightly tetragonal or cubic symmetry; and (2) by comparing the diffuse scattering intensities with measurements of the lattice parameter the absolute concentration and the strength of the defects were determined. A reasonable set of values is: the volume change ΔV per interstitial is 1.45 atomic volumes, the volume change by the relaxation around a vacancy is -0.4 atomic volumes and the specific resisistivity per Frenkel pair ρ_F is 2.0 $\mu\Omega$cm/at%. (auth)

12087 INVESTIGATION OF FRENKEL DEFECTS IN ELECTRON IRRADIATED COPPER BY HUANG SCATTERING OF X RAYS. II. Thermal Annealing. Ehrhart, P.; Schlagheck, U. (Kernforschungsanlage, Juelich, Ger.). J. Phys., F (London); 4: No. 10, 1589-1598 (Oct 1974).

After low temperature electron irradiation of copper single crystals the thermal recovery behavior was investigated by measurements of the diffuse scattering of x rays close to the Bragg reflections and by measurements of the electrical resistivity change. At the end of recovery stage I an increase of the scattering intensity per interstitial was observed. This gives direct evidence that the interstitials agglomerate during their free migration. In recovery stage II a further increase of the scattering intensity per interstitial suggests an increase of the average interstitial cluster size throughout this stage. The mean number of interstitials per cluster can be estimated. At the end of stage I it is in the order of 5 to 10 interstitials. The cluster size increases to about 80 at the beginning of stage III and further increases to about 500 at the end of this stage. The interstitial clusters form loops on {111} or {110} planes. At the end of stage III there is strong indication that vacancies form additional small clusters (loops). These results can be compared with observations in the electron microscope. (auth)

12088 RADIATSIONNYE EFFEKTY V MONOKRISTALLAKH. (Radiation Effects in Monocrystals). Gulyamov, U. G. (ed.). Tashkent; Izdatel'stvo Fan Uzbekskoi SSR (1973). 199p.

Questions related to the nature of the action of various penetrating radiations on the physical properties of monocrystals are answered. Considerable attention is given to calculations and analyses of the mechanisms of defect formation and radiation changes in the structure of bodies, made on the electronic computer. The mechanical properties of germanium and silicon are studied, along with the effect on them of gamma and neutron radiation, the optical properties of laser materials, and radiation transformations in ferroelectrics. The monograph is designed for scientific workers and engineers interested in problems of radiation physics. (tr-auth)

12089 KINETICS OF FORMATION AND NATURE OF ACCEPTOR-TYPE DEFECTS GENERALIZED BY γ RAYS IN GERMANIUM. Mashovets, T.V. (A. F. Ioffe Physicotechnical Institute, Academy of Sciences of the USSR, Leningrad). Sov. Phys.-Semicond. 8: No. 6, 754-757 (Dec 1974).

A model proposing the participation of an interstitial group V impurity atom D_i in the formation of radiation defects with an acceptor level $E_c-0.2$ eV is used in a calculation of the kinetics of the formation of such defects. It is shown that the kinetics can be described by assuming that the acceptor level $E_c-0.2$ eV appears as a result of a change in the interstitial configuration of the group V atom $D_i \rightarrow D^*_i$. Only ionized D_i^+ atoms, with a donor level located not higher than $E_c-0.4$ eV, can participate in this process. The threshold energy for the formation of a D^*_i center lies within the range 1.0-0.8 eV. (auth)

12090 PINNING OF DISLOCATIONS BY POINT DEFECTS IN LOW TEMPERATURE ELECTRON IRRADIATED COPPER. Lauzier, J.; Minier, C. (CEN, Grenoble, France). Radiat. Eff.; 22: No. 3, 191-193 (1974).

The variations of modulus and damping in copper were measured during 2-MeV electron irradiations at temperatures between 8 K and 140 K. The measurements were performed at the irradiation temperature and at a reference temperature close to 4 K. In both cases a maximum in the pinning rate of the dislocations, around 70 K, is found and discussed. (auth)

12091 PROTON RANGE AND ENERGY IN IRRADIATED TYPE 316 STAINLESS STEEL. Keefer, D. W.; Pard, A. G. (Atomics International Div., Canoga Park, CA). Radiat. Eff.; 22: No. 3, 181-186 (1974).

Cross-section transmission-electron-microscope foils of Type 316 stainless steel were used to determine the depth to which voids are formed during proton irradiation at energies between 0.75 and 1.05 MeV. These void depths, which can be determined with an accuracy of ± 5 percent, were found to exceed by a rather large amount (10^{-4} cm) the results from range-energy data tables prepared specifically for stainless steel. Experimental and microstructural features which could lead to this apparent discrepancy are discussed. It is concluded that the depth to which voids are formed gives a good measure of the proton range at a particular energy. Values of calculated proton energy vs. penetration which best agree with the experimental depth data are presented. (auth)

12092 INTERNAL FRICTION PEAK OBSERVED IN 77 K NEUTRON IRRADIATED TITANIUM. Pichon, R.; Bisogni, E.; Moser, P. (CEN, Grenoble, France). Radiat. Eff.; 22: No. 3, 173-179(1974). (In French).

Four internal friction peaks are observed in 77 K neutron irradiated titanium. The first and a component of the second peak are attributed to the free interstitial reorientation. This self interstitial is monoclinic and disappears at the end of stage I by three dimensional migration. After cold work at room temperature the titanium sample was found to show the 140 K peak previously observed by Hasiguti et al., (Acta Met.; 10: 442 (1962)). The peak did not appear when cold work was performed at 77 K. On the contrary this peak appeared when the titanium contained self interstitials introduced by irradiation previously to the 77 K cold work. A mechanism is proposed. (auth)

12093 NEUTRON IRRADIATION EFFECT ON THE MECHANICAL PROPERTIES AND THE VALUE OF THE PROGRAMMED TITANIUM STRENGTHENING EFFECT. Gindin, I. A.; Lapiashvili, Eh. S.; Naskidashvili, I. A.; Neklyudov, I. M. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.; AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). Probl. Prochnosti; No. 8, 49-52(Aug 1973). (In Russian).

For English translation see the journal Strength Mater.

The effect of neutron irradiation with integral doses of 1.2×10^{18} and 3.2×10^{18} n/cm^2 at 130°C on the mechanical properties of polycrystalline Ti and on the size of the effect of secondary hardening after annealing without load and under evenly increasing load in the macroelastic deformation region at 20 and 200°C was studied. It was shown that irradiation increases the yield point approximately 40%, but irradiation and subsequent annealing under an evenly increasing load increase the yield point of Ti by almost a factor of two. (tr-auth)

12094 EFFECT OF TARGET TEMPERATURE ON SURFACE COMPOSITION CHANGES OF Cu-Ni ALLOYS DURING Ar ION BOMBARDMENT. Shimizu, H.; Ono, M.; Nakayama, K. (Electrotechnical Laboratory, Tanashi, Tokyo, Japan). J. Appl. Phys. 46: No. 1, 460-462 (Jan 1975).

The effect of target temperature on surface composition changes of Cu-Ni alloys during Ar ion bombardment was studied by means of quantitative Auger electron spectroscopy. After sputtering at various temperatures the surface composition changes were analyzed at room temperature. At room temperature, the surface was enriched with Ni. It was found that the sputtering yield ratio of Cu/Ni was 1.9 over a whole range of the composition and that the value was almost coincident with that estimated from pure metals. As the temperature increased, the inclination toward Ni enrichment was enhanced. Though the sputtering yields of pure metals were independent of the temperature, in the alloys the yield ratio increased to 3.5 at 250 °C. However, above 400 °C the yield ratios decreased. The surface composition was mainly determined by the fast diffusion of Cu on the sputter-damaged layers. (auth)

12095 SHORT-RANGE ORDER IN Au-Fe RADIATION-ENHANCED DIFFUSION AND THE EFFECTIVENESS OF 14-MeV NEUTRONS. Borg, R.J. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550); Dienes, G.J. J. Appl. Phys. 46: No. 1, 99-104 (Jan 1975).

Solute clustering in a Au-Fe (17% Fe) alloy has been demonstrated by Mössbauer effect measurements of the magnetic ordering temperature. Neutron irradiation at room temperature produces clustering by means of radiation-enhanced diffusion, while annealing at high temperatures is required to produce clustering thermally. The radiation-enhanced diffusion effect was used to compare directly the efficiency of mobile defect production by 14-MeV fusion neutrons and reactor neutrons. The 14-MeV neutrons are more effective by about a factor of 10 than the reactor neutrons ($E > 0.1$ MeV) in producing mobile lattice defects. Other compositions failed to respond to radiation-induced clustering, suggesting that Au-17-Fe is in a critical composition region regarding the response of the magnetic ordering temperature to variations in short-range order. (auth)

Other Materials

Refer also to abstracts 10699, 10719-10721, 10756, 10762-10764, 10769, 11764, 11925, 11936, 11982, 12080, 12717, and 13049.

12096 (CONF-741002-P2, pp 550-558) CRYSTAL STRUCTURE OF ORTHORHOMBIC LANTHANUM DIHYDROXIDE MONONITRATE AND CRYSTAL CHEMISTRY IN TERNARY SYSTEMS: LANTHANUM + HYDROXIDE + MONOVALENT ANION. Wyles, L. R.; Deline, T. A.; Haschke, J. M.; Peacor, D. R. (Univ. of Michigan, Ann Arbor). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The structure of the high temperature polymorph of $La(OH)_2NO_3$ was investigated by single crystal x-ray diffraction procedures. A pronounced substructure-superstructure relationship was observed. The orthorhombic substructure ($Cmc2_1$, $C2cm$, or $Cmcm$, $a = 4.076(2)$ Å, $b = 13.070(8)$Å, $c = 7.208(4)$Å, $Z = 4$) was solved and found to be a $PuBr_3$-type structure. Layering mechanisms and other structural similarities of hydroxide anion phases, $Ln_2(OH)_{6-x}(X)_x$, are described; the effects of nitrate disorder and hydrogen bonding on the superstructure and the incomplete refinement of nitrate positions are discussed. (auth)

12097 (CONF-741002-P2, pp 1039-1047) ENTROPY AND ENTHALPY OF SUBLIMATION OF DYSPROSIUM, HOLMIUM, AND ERBIUM TRIFLUORIDES. McCreary, J. R.; Thorn, R. J. (Argonne National Lab., IL). 1974.

From 11th rare earth research conference; Traverse City, Michigan, USA (7 Oct 1974).

In proceedings of the 11th rare earth research conference.

The entropy and enthalpy of sublimation of Dy, Ho, and Er trifluorides were measured. The values for the enthalpies and entropies of sublimation derived through linear least squares' analyses of log p vs T^{-1} and log IT vs T^{-1} for the mass-effusion (based on molecular weight for the trifluorides) and mass-spectrometric measurements respectively are listed. The associated errors are standard deviations. Also listed are the number of measurements and the temperature interval over which measurements were made. The square roots of the sums of the squared residuals, i.e., the deviations of the experimental values for log p or log IT from the least squares' calculated values are also listed. (JRD)

12098 (GA-A-13089) FINAL REPORT ON GRAPHITE IRRADIATION TEST OG-1. Price, R. J.; Beavan, L. A. (General Atomic Co., San Diego, Calif. (USA)). 1 Aug 1974. Contract AT(04-3)-167. 92p. Dep. NTIS $5.45.

Results of dimensional measurements and physical property tests on graphite samples irradiated in capsule OG-1 are presented. Samples of H-327 (needle-coke graphite), H-429 and H-451 (near-isotropic petroleum-coke graphites), P_2JHAN (pitch-coke graphite), and other miscellaneous graphites were irradiated at temperatures from 600 to 1400°C to fluences from 1.6 to 3.7×10^{21} n/cm^2 ($E > 0.18$ MeV). Irradiation-induced shrinkages were smaller and more isotropic in the H-429 and H-451 graphites than in either the needle-coke or pitch-coke graphites irradiated under similar conditions. Irradiation-induced changes in the thermal expansivity of H-327 graphite were insignificant. Irradiation caused a small increase in the thermal expansivity of H-429 and H-451 graphites at irradiation temperatures below about 900°C and a slight decrease at higher temperatures. Irradiation reduced both the thermal conductivity of H-327 and H-451 graphites and its temperature dependence. After irradiation at 600 and 900°C, the radial conductivity of H-451 graphite was about 50% higher than the radial conductivity of H-327 graphite and about equal to the axial conductivity of H-327 graphite. Irradiation increased both the strength and Young's modulus of H-327 and H-451 graphites, with a greater increase at lower irradiation temperatures than at higher irradiation temperatures. Percentage increases in strength fell in the range 30 to 60%, while increases in Young's modulus ranged from 60 to 130%. (auth)

12099 (JINR-P14-8156) ANALYSIS OF EXPERIMENT ON INELASTIC NEUTRON SCATTERING ON CRYSTAL LEVELS OF Pr^{3+} IN PrF_3. Welsch, D.; Matthies, S.; Hennig, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 21p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.25.

By using a semiempirical fitting approach and appropriate results of optical spectroscopy and inelastic neutron scattering experiments the energy-level scheme of the crystal field-splitted $^3H_4$—multiplet of Pr^{3+} in PrF_3 is determined. (auth)

12100 (JUL-1078-RW) METHODS FOR THE CHARACTERIZATION OF PYROLYTIC DEPOSITED CARBON. Characterization Procedures Applied in the Institut fuer Reaktorwerkstoffe. Bongartz, K.; Hoven, H.; Koizlik, K.; Krautwasser, P.; Luhleich, H.; Scheer, J.; Schulze, H. A.; Taeuber, K.; Thiele, B.; Wallura, E.; Yust, C. S. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jun 1974. 91p. (In German). Dep. NTIS (U. S. Sales Only) $7.75.

Pyrocarbon is deposited as a coating material of fuel kernels used in High Temperature Gas Cooled Reactors. For the development of particle coatings specified for the various reactor designs it is necessary to know about the properties of pyrocarbon and their changes by neutron irradiation. Procedures are described

which are used in the Institut für Reaktorwerkstoffe to characterize pyrocarbon. These procedures are: measurement of geometry, density, microporosity, apparent crystallite size, anisotropy of orientation, modulus of elasticity and strength of coatings, as well as ceramography, etching by oxidation, and secondary and transmission electron microscopy. (auth)

12101 (NBS-TN-641) SURVEY OF THE PROPERTIES OF THE HYDROGEN ISOTOPES BELOW THEIR CRITICAL TEMPERATURES. Roder, H. M.; Childs, G. E.; McCarty, R. D.; Angerhofer, P. E. (National Bureau of Standards, Boulder, Colo. (USA). Inst. for Basic Standards). Aug 1973. 113p. GPO $1.25.

The survey covers PVT, thermodynamic, thermal, transport, electrical radiative, and mechanical properties. All isotopic as well as ortho-para modifications of hydrogen have been included. Temperatures are limited to those below the respective critical points, in general below 40°K. The pressure range is not restricted, that is solid, liquid, and gas phases are covered. However, with the exception of hydrogen, very little data exists at pressures other than saturation. The literature surveyed includes all references available to the Cryogenic Data Center up to June of 1972, and for several subjects, through March of 1973. The total number of documents considered was nearly 1500 of which about 10 percent contain pertinent information and are referenced in this report. The various properties are presented in the form of tables or graphs; if extensive tables have been published elsewhere, the reader is referred to the original sources. (auth)

12102 (UUIP-870) COLLECTION OF LARGE AMOUNTS OF XENON IN SOLID TARGETS. Arnesen, A.; Noreland, T.; Norlin, L. O. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

Targets containing a considerably higher dose of implanted atoms than earlier reported saturation values have been made with an isotope separator. The collected atoms seem, however, to be embedded in a carbon layer on the target surface rather than implanted in the target material in the usual sense. For 35-keV xenon ions impinging on iron, concentrations as high as 85 $\mu g/cm^2$ were measured. The targets were used to determine nuclear magnetic moments and B(E2, $0^+ \rightarrow 2^+$) values for even xenon isotopes. (auth)

12103 ELECTRON IRRADIATION DAMAGE IN SILICON CONTAINING CARBON AND DIFFUSE ^{18}O. Abou-el-Fotouh, F. A.; Newman, R. C. (Univ. of Reading, Eng.). Solid State Commun.; 15: No. 8, 1409-1411(15 Oct 1974).

Silicon crystals were diffused with ^{18}O, irradiated with 2 MeV electrons at room temperature, and then annealed up to 400°C. Infrared absorption measurements of the localized vibrational modes of various defects were made at each stage. (auth)

12104 NEUTRON DIFFRACTION STUDY OF U_3As_4. Sechovsky, V.; Smetana, Z.; Menovsky, A. (Charles Univ., Prague). Phys. Status Solidi (a); 26: No. 1, K13-K15(16 Nov 1974).

Neutron diffraction measurements were made at 4.2 to 300°K. Data at 300°K are consistent with the Th_3P_4 structure with a = 8.497 ± 0.007 Å and As atom parameter u = 0.083. The temperature variation of the (211) peak gives the Curie point T_c = 200 ± 5°K. Below T_c, where (110) and (200) reflections might occur, no new peaks were detected. (DLC)

12105 INFLUENCE OF THE CRYSTAL LATTICE ON THE ANGULAR DISTRIBUTION OF X-RAYS EMITTED FROM A GaP SINGLE CRYSTAL BY FAST PROTON BOMBARDMENT. Geist, V.; Flagmeyer, R. (Karl-Marx Univ., Leipzig). Phys. Status Solidi (a); 26: No. 1, K1-K3(16 Nov 1974).

In a study of the blocking effect on a GaP monocrystal, cut parallel to {111}, a dark circle around the $[\bar{1}\bar{1}\bar{1}]$ axis was recorded on the photographic plate. Since a mylar–Al foil does not remove the circle, but a Cu foil does, the circle is probably caused by soft x rays. The proton energy range, 0.5 to 1.5 MeV, does not affect the circle diameter. This is probably the Kossel effect induced by protons instead of ions. For the bombarded B-face, light circles with dark exterior edges were recorded, in contract to the dark circles for the A-face. (DLC)

12106 F-CENTRE GROWTH KINETICS AND THERMOLUMINESCENCE IN CESIUM HALIDES. Radhakrishna, S.; Narayanan, R. (Indian Inst. of Tech., Madras). Phys. Status Solidi (a); 26: No. 1, 337-344(16 Nov 1974).

The growth rate of F-centers as a function of the time of x-irradiation and the thermoluminescence (TL) of x-ray-colored cesium halides were studied. In the case of CsCl and CsBr, the Cd impurity suppresses growth of the F-band. The first stage growth of F-centers was analysed into further "exponential" substages. The first stage in CsBr consists of at least two substages, whereas the analysis of CsCl crystals yielded only one substage for the first stage. Two TL glow peaks were found in x-irradiated CsBr at 110 and 125°C. Results suggest that these are due to the recombination of the F-center electrons with holes. In CsCl, the TL glow peaks attributable to F-centers are observed at 100, 120, and 135°C. In Cd-doped crystals, new glow peaks were observed which are attributed to centers involving Cd impurity, by comparison with optical absorption studies. The trap depths of the glow peaks were evaluated using the "initial rise method." (5 fig, 2 tables) (auth)

12107 AMORPHOUS LAYER FORMATION IN SILICON BY ION IMPLANTATION. Bourgoin, J. C. (Univ., Paris); Morhange, J. F.; Beserman, R. Radiat. Eff.; 22: No. 3, 205-208 (1974).

The introduction of disorder in silicon caused by the implantation of 70 keV argon ions has been studied using electron paramagnetic resonance and Raman scattering. It is observed that the EPR signal is not saturated when the crystalline structure (as seen by Raman scattering) has totally disappeared. The disorders measured using these two methods are compared with each other and with previously published data. It is concluded that when the saturation of the disorder is observed, it is not possible to assert that a continuous amorphous layer is formed because this saturation is not independent of the experimental technique used. It is also shown that Raman scattering can be a useful and precise technique to monitor the introduction of disorder within an implanted layer. (auth)

12108 SYSTEM Ce–Cu–Si. Bodak, O. I.; Kalychak, Ya. M.; Gladyshevskii, E. I. (L'vov State Univ.). Inorg. Mater. (USSR) (Engl. Transl.); 10: No. 3, 388-391(Mar 1974).

Translated from Izv. Akad. Nauk SSSR, Neorg. Mater.; 10: No. 3, 450-455(Mar 1974).

X-ray and microstructural methods were used to investigate phase equilibria in the system Ce–Cu–Si in the concentration regions 0 to 33.3 at.% Ce at 600°C and 33.3 to 100 at.% Ce at 400°C. Existence of the compounds $CeCu_2Si_2$, $CeCu_{1.91-1.10}Si_{0.81-0.90}$, and $CeCu_{0.76-0.44}Si_{1.24-1.56}$ was confirmed. Regions of homogeneity of the last two compounds were determined with greater precision. Two new compounds were found and their crystal structures determined: $CeCu_{1.6}Si_{1.4}$ ($CeNiSi_2$ type, space group Cmcm, a = 4.16, b = 17.21, c = 4.17 Å) and $CeCuSi_2$ ($CeNiSi_2$ type, space group Cmcm, a = 4.12, b = 16.48, c = 4.16 Å). (auth)

12109 INDUCED SCATTERING OF NEUTRONS BY AN ELECTROMAGNETIC FIELD. Benoit, C.; Cohen Solal, G. W. (Universite des Sciences et Techniques du Languedoc, Montpellier, France). Phys. Status Solidi (b); 65: No. 2, 721-728(1 Oct 1974).

An investigation is made of the modification of the one-phonon scattering cross section of neutrons when the crystal is irradiated by an infrared monochromatic beam. It is found that under particular conditions an additional peak appears. The magnitude and the position of the peak depend on the intensity and the frequency of the IR beam. (auth)

12110 ELASTIC ELECTRON SCATTERING IN SYMMETRY-INDUCED ZERO-GAP SEMICONDUCTORS. Szymanska, W. (Inst. of Physics, Warsaw); Boguslawski, P.; Zawadzki, W. Phys. Status Solidi (b); 65: No. 2, 641-654(1 Oct 1974).

Relaxation times for elastic electron scattering in the symmetry-induced zero-gap semiconductors of zincblende structure are calculated, taking into account the nonparabolic character of the conduction band both in the density of states and the electron wave functions. The calculation is based on the band structure proposed by Groves and Paul and uses exact $k \cdot p$ solutions for the three-level model of Γ_8, Γ_6, and Γ_7 levels. Electron scattering by charged impurities and heavy holes, optical phonons (screened polar interaction) and acoustic phonons are considered. Spin-flip transitions play an important role for all scattering modes. An anomalous q-dependence of the static dielectric function due to low energy excitations between the Γ_8 heavy hole and conduction bands is shown to have small effect on the ionized impurity scattering at low temperatures. It is demonstrated that transverse modes give a large contribution to acoustic scattering. In all cases the Γ_8 symmetry of the band-edge and the nonparabolicity of the band at higher energies have essential effect on the scattering processes. (auth)

12111 PHOTO-INDUCED ELECTRON SPIN RESONANCE (PHOTO-ESR) IN β-RHOMBOHEDRAL BORON. Nadolny, A. J. (Technische Univ., Clausthal, Ger.). Phys. Status Solidi (b); 65: No. 2, 801-812(1 Oct 1974).

Photo-induced ESR has been investigated in the temperature range 150 to 300°K using nearly homogeneous optical excitation ($h\nu \approx 1.3$ eV). The relaxation of the photo-ESR shows, similarly to that of photoconductivity, two components which are approxi-

mately described by a logarithmical function of time, decay rate being enhanced with increasing temperature. The time and temperature dependences of the photo-ESR as well as the relationship between the photo-ESR and photoconductivity are interpreted on the basis of a model, with traps for electrons having various values of emptying energy continuously distributed in a certain energy range and two kinds of localized valence states. (auth)

12112 RADIATION ANNEALING OF DEFECTS IN NEUTRON–BOMBARDED SILICON. Mordkovich, V.N.; Solov'ev, S.P.; Temper, E.M.; Kharchenko, V.A. Sov. Phys.–Semicond. 8: No. 5, 666-666 (Nov 1974).

The influence of electron bombardment on the optical and electrical conduction properties of neutron irradiated silicon have been investigated. Strong effects were observed on the infrared absorption spectra and these were correlated to point defect annealing processes. (AIP)

12113 PRELIMINARY STUDIES OF THE EFFECTS OF SEALANTS ON RADON EMANATION FROM CONCRETE. Auxier, J. A.; Shinpaugh, W. H.; Kerr, G. D.; Christian, D. J. (Oak Ridge National Lab., TN). Health Phys.; 27: No. 4, 390-392(Oct 1974).

Experimental studies of the emanation of radon from concrete, carried out with the concrete sample in an airtight enclosure providing stable temperature, humidity and dust distribution, are described. Results indicate a negligible temperature effect on the emanation of radon from concrete, between 23 and 43°C, and a relatively strong dependence of radon emanation on the moisture content of the concrete. In studies on the effects of sealants, no reduction in the concentration of radon daughters in the air of the enclosure and no increase in γ-ray emission from radon daughters in the concrete were observed from blocks that were either stuccoed with cement plaster or coated with asphalt. For a similar stuccoed block coated heavily with epoxy paint, both a reduction in the radon daughter concentration in air and an increase in γ-ray emission for radon daughters in the concrete were observed. (UK)

12114 PRODUCTION AND INVESTIGATION OF THIN Gd OXIDE FILMS. Semiletov, S.A.; Imamov, R.M.; Ragimli, N.A. (Institute of Crystallography, Academy of Sciences of the USSR). Sov. Phys.–Crystallogr. 19: No. 3, 386-388 (Nov 1974).

The structure of gadolinium oxide thin films is studied by electron diffraction. (auth)

12115 TEMPERATURE, ILLUMINATION, AND FLUENCE DEPENDENCE OF CURRENT AND VOLTAGE IN ELECTRON IRRADIATED SOLAR CELLS. Faith, T. J. (RCA, Princeton, NJ); Obenschain, A. F. pp 384-392 of Photovoltaic Specialists Conference. New York; Institute of Electrical and Electronics Engineers, Inc. (1974).

From 10th photovoltaic specialists conference; Palo Alto, CA (13 Nov 1973).

Empirical equations were derived from measurements of solar cell photovoltaic characteristics relating light-generated current and open circuit voltage to cell temperature, intensity of illumination and 1-MeV electron fluence. Both 2-ohm-cm and 10-ohm-cm cells were tested over the temperature range from 120 to 470°K, the illumination intensity range from 5 to 1830 mW/sq cm, and the electron fluence range from 1×10^{13} to 1×10^{16} electrons/sq cm. The normalized temperature coefficient of the light generated current varies as the 0.18 power of the fluence for temperatures above approximately 273°K and is independent of fluence at lower temperatures. At 140 mW/sq cm, a power law expression was derived which shows that the light-generated current decreases at a rate proportional to the 0.153 power of the fluence for both resistivities. The coefficient of the expression is larger for 2-ohm-cm cells; consequently, the advantage for 10-ohm-cm cells increased with increasing fluence. (auth)

12116 DAMAGE AND RECOVERY CHARACTERISTICS OF NEUTRON IRRADIATED SOLAR CELLS. Wallis, A. E.; Green, J. M. (Aero Propulsion Lab., Wright-Patterson AFB, Ohio). pp 373-377 of Photovoltaic Specialists Conference. New York; Institute of Electrical and Electronics Engineers, Inc. (1974).

From 10th photovoltaic specialists conference; Palo Alto, CA (13 Nov 1973).

Samples of three types of experimental solar cells were irradiated with neutrons in a fast burst reactor and allowed to anneal at 25, 60, and 80 C. Fluences between 1.72×10^{11} and 2.47×10^{13} 1-MeV equivalent neutrons/sq cm were obtained. Both current-voltage and spectral response characteristics of the cells were monitored during a 1000-hour annealing period. This experiment demonstrated that the COMSAT "super-violet" cell has a higher output both before and immediately after neutron irradiation than the best lithium-doped cells or conventional n/p cells presently available, but after the lithium-doped cells are allowed to anneal the best types are superior to the COMSAT cells for fluences greater than 6×10^{11} neutrons/sq cm. Spectral response data indicate that the primary effect of neutron irradiation on all types of solar cells is to reduce the cell's response to longer-wavelength radiation. (auth)

12117 SPECIFIC HEAT OF GADOLINIUM MOLYBDATE AT THE FERROELECTRIC TRANSITION. Cheung, K.M.; Uliman, F.G. (Electrical Materials Laboratory, University of Nebraska, Lincoln, Nebraska 68508). Phys. Rev. B 10: No. 11, 4760-4764 (1 Dec 1974).

Measurements of the temperature dependence of the specific heat of gadolinium molybdate were carried out from room temperature to 240 °C, using an ac calorimetric method. The specific heat peaks sharply at the 159 °C ferroelectric transition. The data were reproducible on heating and cooling with no thermal hysteresis. The temperature dependence is logarithmic on the low–temperature side of the peak. Above the peak, a weak linear increase with temperature was found; possible logarithmic behavior just above the transition could not be verified. The latent heat and transition entropy calculated from these data were found to be 108 cal/mole and 0.25 cal/mole °K, respectively. (auth)

12118 DIFFUSION OF ^{14}C IN NUCLEAR GRAPHITES. Sach, R. S.; Williams, W. J. (Central Electricity Generating Board, Berkeley). Carbon; 12: No. 4, 425-432(Aug 1974).

The high temperature exchange of ^{14}C between ^{14}CO and ^{12}C-graphite was used to label a large number of samples of various nuclear graphites. The technique makes it possible to obtain data on the self-diffusion of carbon in graphite. Three nuclear graphites are used, Pile Grade A and two isotropic varieties. Diffusion constants at 2473 K lie in the range 0.64×10^{-19} to 2.97×10^{-19} m^2/sec. D_0 values vary from 1.20×10^{-12} to 1.06×10^{-6} m^2/sec and activation energies, E_a, from 337 to 621 kJ/mol. The D values found are lower than those found by other workers. Possible reasons for this are examined. Activation energies are also compared with values found by other workers and discussed in relation to theoretical calculations on the activation energy for direct interchange, vacancy and interstitial mechanisms for diffusion. It is concluded that direct interchange is the predominant mechanism for the diffusion of ^{14}C in the highly graphitized samples. (auth)

12119 NUCLEAR RELAXATION IN LANTHANUM ETHYL SULFATE CONTAINING YTTERBIUM. Valeev, I.I.; Aukhadeev, F.L. (V. I. Ul'yanov–Lenin Kazan' State University). Sov. Phys.–Solid State 16: No. 5, 947-948 (Nov 1974).

We have studied the nuclear spin–lattice relaxation for a crystal of lanthanum ethyl sulfate containing Yb^{3+} ions. The experiment was performed to determine the temperature dependence in the range 1.5 to 30°K. (AIP)

12120 FORMATION OF TRAPPING CENTERS IN CdS SINGLE CRYSTALS AS A RESULT OF IRRADIATION WITH Co^{60} γ RAYS AND 1.8 MeV ELECTRONS. Galushka, A. P.; Davidyuk, G.E. (Institute of Nuclear Research, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. Phys.–Semicond. 8: No. 6, 693-695 (Dec 1974).

An investigation was made of the parameters and annealing of trapping centers in CdS single crystals. These centers were introduced by irradiation with Co^{60} γ rays and fast electrons of 1.8 MeV energy at temperatures of 30–60°C. Such irradiation generated deep electron–trapping centers with ionization energies of 0.44, 0.52, and 0.8 eV. A study was made of the thermal stability of the defects responsible for the levels at 0.44 and 0.8 eV. The former defects were annealed at 210–260°C, and the activation energy of annealing was ~1 eV. The latter defects were annealed at 80–180°C. (auth)

12121 EFFECT OF METALS AND SURFACE CONTAMINANTS ON THE DECORATION OF GRAPHITE. Baird, T.; Fryer, J. R.; Arbuthnott, A. R.; McAneney, B.; Riddell, E. V.; Walker, D. (Univ. of Glasgow). Carbon; 12: No. 4, 381-390(Aug 1974).

The decoration of graphite with Ag, Au, Pd, Fe, In, Zn, and K was attempted. Both nuclear grade graphite and spectroscopically purified natural graphite were used and a variety of pretreatments with solvent and thermal treatment were carried out to determine their effect upon decoration. Efforts to decorate the graphite while viewing in the electron microscope were unsuccessful probably because of the contamination that was caused to deposit on the specimen by the electron beam. The results are explained in the terms of interaction between the decorating particle and the graphite surface via chemisorbed species. (auth)

12122 NEW EPR SPECTRA IN NEUTRON-IRRADIATED SILICON (II). Lee, Y. H.; Brosious, P. R.; Corbett, J. W. (State Univ. of New York, Albany). Radiat. Eff.; 22: No. 3, 169-172(1974).

Four new EPR spectra, arising from intrinsic defects in silicon created by neutron-irradiation, are resolved. Each

spectrum is briefly discussed. Further detailed studies are required to establish defect models. (auth)

12123 METHOD FOR INDEXING NEUTRON POWDER DIFFRACTION PEAKS FROM SPIRAL SPIN ANTIFERROMAGNETS. Knapp, B. M.; Sinclair, F.; Wilkinson, C. (Queen Elizabeth Coll., London). J. Appl. Crystallogr.; 7: No. 3, 370-372(1 Jun 1974).

A method is presented for the indexing of satellite diffraction peaks which arise in neutron powder diffraction patterns of spiral spin antiferromagnets with general propagation vectors. It has been successfully used to determine the propagation vector in $Cu_{\frac{1}{2}}Ga_{\frac{1}{2}}Cr_2S_4$ and also to confirm the direction of the propagation vectors in other materials with known structures. (auth)

12124 INFLUENCE OF RADIATION CROSS-LINKING CONDITIONS ON ELECTRIC PROPERTIES OF POLYETHYLENE. Fedotov, B. G.; Ehjedel'nant, M. P.; Sirota, A. G.; Lobanov, A. M.; Il'chenko, P. A.; Kharitonova, O. K. Plast. Massy; No. 12, 18-21 (Dec 1973). (In Russian).

For English translation see the journal Sov. Plast.

The results of studies on the selection of conditions for the γ irradiation and the thermal processing of high and low density polyethylene samples and of copolymers of ethylene with propylene and α-butylene with different degrees of crystallinity were reported. Data were given showing that with a correct selection of the irradiation conditions for polyethylene with consideration of its structure, heat resistant materials can be produced with high dielectric characteristics, suitable for use as heat resistant dielectrics at high and superhigh frequencies. (tr-auth)

12125 INFLUENCE OF CASTING PARAMETERS ON PROPERTIES OF PRODUCTS FROM IRRADIATED POLYETHYLENE. Ermakov, E. P.; Knyazev, V. K.; Sheryshev, M. A.; Salazkin, K. A. Plast. Massy; No. 9, 23-26(1973). (In Russian).

For English translation see the journal Sov. Plast.

The relation between the parameters of the technological process of the reprocessing of high density polyethylene after casting under pressure and changes of its properties following γ irradiation was studied. The different character of the behavior during irradiation of the polyethylene obtained under different casting regimes under pressure was established. The smallest changes of the parameters of polyethylene during irradiation correspond with the very high values of the reprocessing and the time delay under pressure. The same radiation effects can be observed at doses differing by factors of 3 to 4 as a function of the reprocessing regime of the polymer. (tr-auth)

12126 METHODOLOGY QUESTIONS OF ESTIMATE OF POLYMERS RADIATION STABILITY. Knyazev, V. K. Plast. Massy; No. 12, 16-18(Dec 1973). (In Russian).

For English translation see the journal Sov. Plast.

Some questions on the terminology and methodology related to the evaluation of the radiation stability of polymer materials were examined. A single approach to the evaluation of the radiation stability was justified and a method for its expression through a universal coefficient of radiation stability in accordance with a five-point scale was proposed. An arbitrary recording of the results of radiation experiments reflecting the basic data on the test conditions was proposed. (tr-auth)

12127 SUPRALINEARITY AND SENSITIZATION IN LiF TLD PHOSPHOR. Jain, V. K.; Kathuria, S. P.; Ganguly, A. K. (Bhabha Atomic Research Centre, Bombay). J. Phys., C (London); 7: No. 20, 3810-3816(21 Oct 1974).

New data on post-irradiation annealing of LiF TLD phosphor are presented. The results show a new peak at 400°C and increased availability of luminescence centers that are responsible for the radiation-induced sensitization. A model to explain the observed phenomena is presented. The new peak trap centers and the increase in luminescence centers are attributed to the breakup, on irradiation, of a complex center. The complex center itself is formed on annealing at 400°C. (auth)

12128 ESR STUDIES OF PARAMAGNETIC CENTRES IN IRRADIATED $Sr(ClO_3)_2$ SINGLE CRYSTALS. Suryanarayana, D.; Sobhanadri, J. (Indian Inst. of Tech., Madras). J. Phys., C (London); 7: No. 20, 3770-3778(21 Oct 1974).

Paramagnetic centers produced by irradiation of $Sr(ClO_3)_2$ single crystals were studied by electron spin resonance. The products of x- or γ-irradiation at 298°K are ClO_2 and O_3^- centers. ClO_2 is trapped at six magnetically inequivalent sites in the crystal lattice, forming three pairs. The magnetic parameters for two of the pairs, that is, ClO_2(B) and ClO_2(C), are in close agreement with ClO_2 centers reported in other systems; while the third pair, that is ClO_2(A), has slightly different hyperfine parameters. The principal g values of this center (A) are $g_{xx} = 1.9984$, $g_{yy} = 2.0170$ and $g_{zz} = 2.0142$ and those of the A tensor are $A_{xx} = 90.0$ G, $A_{yy} = -8.7$ G and $A_{zz} = -5.0$ G. The chlorine centers that are trapped at six magnetically inequivalent sites produced by radiation damage reveal hexagonal symmetry among themselves. UV or thermal bleaching (at 90°C) removes all the chlorine centers, giving a single anisotropic line, trapped at two magnetically inequivalent sites with a $g_{av} = 2.0092$. This new center is identified as an O_3^- center. (auth)

12129 SOUND VELOCITIES IN SOLID hcp H_2 AND D_2. Wanner, R.; Meyer, H. (Duke Univ., Durham, NC). pp 189-193 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Transverse and longitudinal sound velocities were measured at 1.25 to 20°K in solid hcp H_2 and D_2 with various ortho-para ratios. From these data, the five independent elastic constants for the hcp lattice, the Debye temperature, and the bulk modulus were calculated. The dependence of the velocities on the mole fraction of molecules having a rotational angular momentum J = 1 (ortho-H_2 or para-D_2) was also measured. (DLC)

12130 POLARIZABILITY OF SOLID H_2 AND D_2. Wallace, B. Jr.; Meyer, H. (Duke Univ., Durham, NC). pp 194-197 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The polarizability α was determined from dielectric constant measurements for solid H_2 and D_2 at 1.2 to 10°K and with varying content (X) of the J = 1 isomer. Results are also given for ^{4}He and Ne. A strong temperature dependence of α of Ne above 4°K, but a smaller one for H_2(X = 0), were found. That of H_2(X = 0.75) is not very different from that of H_2(X = 0), and no change in α occurred at the hcp–cubic transition near 1.5°K for H_2(X = 0.75), indicating that orientation order has little effect on α; D_2(X = 0.33) has a strong temperature dependence of α. α of the liquid and solid H_2 is the same within 0.2%. The melting pressure of H_2 (X = 0) is 3.6 ± 0.2 atm higher than that of H_2(X = 0.75). (DLC)

12131 DETERMINATION OF THE CRYSTAL STRUCTURES OF D_2 BY NEUTRON DIFFRACTION. Mills, R. L.; Yarnell, J. L.; Schuch, A. F. (Los Alamos Scientific Lab., NM). pp 203-209 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

A filling procedure using liquid He was used to prepare D_2 powder of random orientation. Neutron diffraction was carried out in the Los Alamos Omega West reactor. The para content was 2, 29, or 96%. Structure factors were calculated from the intensities and compared with these for a cubic lattice. Results indicate that the as-frozen cubic D_2 at 4°K is disordered cubic; when it warmed up to 10°K, it transformed to disordered hexagonal. Hcp D_2 with the highest para content transformed to the cubic phase when cooled to 1.5°K, but the transition was never complete. (3 tables, 3 fig) (DLC)

12132 GROWTH AND NEUTRON DIFFRACTION EXPERIMENTS ON SINGLE CRYSTALS OF DEUTERIUM. Votano, J.; Erickson, R. A.; Harris, P. M. (Ohio State Univ., Columbus). pp 215-217 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

To study the low-temperature structure of enriched para-deuterium, a neutron diffraction study was conducted on single crystals in four different cell designs at 1 to 18°K. Techniques were also established for preparing and cooling single crystals. The observed He pressure vs temperature was plotted for one experiment, together with molar volumes (no change was observed except a small one at 1.3°K). Volumetric expansion coefficients were estimated. Orientation ordering at 1.3°K is suggested. Additional experiments are proposed. (DLC)

12133 PROTON RESONANCE IN HIGHLY POLARIZED HD. Bozler, H. M.; Graf, E. H. (State Univ. of New York, Stony Brook). pp 218-222 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

A property important to the production and maintenance of nuclear polarization is the spin–lattice relaxation time T_1, which in HD is affected by ortho-H_2 impurity, temperature T, and mag-

netic field H_0. Proton relaxation times in HD are presented as a function of each of these variables. Results are plotted and compared with the theory of Sung (Phys. Rev. 177: 435 (1969)). Problems in constructing polarized HD targets are considered briefly. (DLC)

12134 THERMAL CONDUCTIVITY OF SOLID HD CONTAINING ISOTOPIC IMPURITIES. Constable, J. H.; Gaines, J. R. (Ohio State Univ., Columbus). pp 223-226 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

Measurements were carried out over 271 h at 4 to 0.2°K. The initial ortho-H_2 content was 0.97%, decreasing to 0.14% over the time duration. The ortho-H_2 dependence is compared to the theory of Ebner and Sung and found to agree above 0.6°K. Isotopic scattering dominates the high-temperature data. The low-temperature results were characteristic of boundary scattering, from which it was inferred that the sample was polycrystalline. (DLC)

12135 SPECIFIC HEAT OF SnTe BETWEEN 0.06 AND 30°K UNDER STRONG MAGNETIC FIELD. Mathur, M. P. (Westinghouse Research Lab., Pittsburgh); Ashkin, M.; Hulm, J. K.; Jones, C. K.; Conway, M. M.; Phillips, N. E.; Simon, H. E.; Triplett, B. B. pp 601-604 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

The low-temperature specific heat of p-type SnTe was measured for various carrier densities and for several doping techniques. Results for self-doped ($Sn_{1-x}Te$) and Ag-doped samples suggest the presence of two different bands, with two different effective masses. Data for Mn-doped samples indicate an ordering of the Mn spins. The magnetic field for the Mn-doped samples was varied from 0 to 30 kOe; the data are best fit with theoretical ½ Schottky curves. (DLC)

12136 EXPERIMENTAL COMPRESSIONS FOR NORMAL HYDROGEN AND NORMAL DEUTERIUM TO 25 KBAR AT 4.2 K. Anderson, M.S.; Swenson, C.A. (Ames Laboratory, United States Atomic Energy Commission and Department of Physics, Iowa State University, Ames, Iowa 50010). Phys. Rev. B 10: No. 12, 5184-5191 (15 Dec 1974).

The piston–displacement technique has been used to determine the pressure–volume relations for normal hydrogen ($n-H_2$) and normal deuterium ($n-D_2$) at pressures to 25 kbar at 4.2 K. The accuracy of the relative compressions V/V_0 ranges from $\pm\ 10^{-3}$ at low pressures to $\pm\ 3\times10^{-3}$ at 25 kbar. The data, especially for $n-H_2$, agree well with earlier 20–kbar results, and the extrapolated $P = 0$ bulk moduli, 1.70 $\pm$ 0.06 kbar for $n-H_2$ and 3.15 $\pm$ 0.06 kbar for $n-D_2$, are consistent with recent ultrasonic data. The shapes of the pressure–volume relations resemble more closely those for the helium isotopes than those for the heavier–rare–gas solids, and suggest that the two–body repulsive interaction for hydrogen molecules (and helium atoms) varies more slowly with intermolecular spacing than that for the heavier–rare–gas atoms. These experiments also give maximum values for the pressure–dependent shear yield stress of solid hydrogen. (auth)

12137 HIGH–SENSITIVITY OPTICAL RECORDING IN KTN BY TWO–PHOTON ABSORPTION. von der Linde, D.; Glass, A.M.; Rodgers, K.F. (Bell Laboratories, Murray Hill, New Jersey 07974). Appl. Phys. Lett. 26: No. 1, 22-24 (1 Jan 1975).

Birefringence changes are induced in a cubic potassium tantalate niobate crystal with an external electric field by two–photon absorption of picosecond optical pulses. The recording sensitivity of 100 $\mu J/cm^2$ for elementary holograms with a few percent reconstruction efficiency is comparable to the sensitivity of holographic silver halide emulsions. The high sensitivity of KTN is shown to be due to efficient charge transport of photoexcited carriers. (auth)

12138 INVESTIGATION OF TELLURIUM–IMPLANTED SILICON. Lee, T.F.; Pashley, R.D.; McGill, T.C.; Mayer, J.W. (California Institute of Technology, Pasadena, California 91109). J. Appl. Phys. 46: No. 1, 381-388 (Jan 1975).

Hall and sheet–resistivity measurements as a function of temperature combined with layer removal have been used to study Si implanted with Te at energies up to 220 keV. At low doses ($\lesssim 4\times10^{13}$ cm^{-2}), Te has a donor level with a 140–meV activation energy. The activation energy decreases at higher Te doses and is approximately equal to zero for Te doses $\gtrsim 10^{15}$ cm^{-2}. At high dose levels, the number of conduction electrons per unit area N_e is more than an order of magnitude below the number of Te per unit area. High–temperature anneal treatments followed by quenching did not produce a substantial increase in N_e, suggesting that the formation of Te clusters was not responsible for the low value of N_e. Also, channeling measurements indicated a high substitutional fraction. Based on differential Hall measurements on samples implanted with phosphorus, with and without Si predamage, we conclude that residual radiation damage is not a major factor. A theoretical calculation, which includes the effect of decrease of activation energy with increasing impurity concentrations, indicated that the number of conduction electrons could be much less than the number of implanted Te even though the apparent activation energy is almost zero. Although the results of theoretical calculation do not give quantitative agreement with the experimental results, they do confirm the changes in apparent activation energy with concentration. (auth)

12139 NITROGEN–IMPLANTED SILICON. I. DAMAGE ANNEALING AND LATTICE LOCATION. Mitchell, J.B.; Pronko, P.P.; Shewchun, J.; Thompson, D.A. (Department of Engineering Physics, McMaster University, Hamilton, Ontario, Canada); Davies, J.A. J. Appl. Phys. 46: No. 1, 332-334 (Jan 1975).

The radiation damage and implanted atom location properties of nitrogen–implanted silicon have been studied. Helium–ion backscattering has been used to measure the damage for samples implanted at various doses and annealed to temperatures as high as 900 °C. The location of the implanted nitrogen in the silicon lattice has been investigated by using the $^{15}N(p,\alpha)^{12}C$ nuclear reaction together with channeling techniques. The results indicate that >90% of the implanted atoms are located in nonsubstitutional positions in the silicon lattice, and that the implanted nitrogen has not outdiffused for anneals to 1185 °C. The results presented here will be used in Paper II to help explain many of the observed electrical porperties of nitrogen–implanted silicon. (auth)

12140 NITROGEN–IMPLANTED SILICON. II. ELECTRICAL PROPERTIES. Mitchell, J.B.; Shewchun, J.; Thompson, D.A. (Department of Engineering Physics, McMaster University, Hamilton, Ontario, Canada); Davies, J.A. J. Appl. Phys. 46: No. 1, 335-343 (Jan 1975).

This paper presents measurements of capacitance–voltage, Hall–effect, and diode characteristics on nitrogen–implanted silicon as a function of anneal temperature. The results of these three types of electrical measurements are consistent and show that less than 1% of the implanted nitrogen exhibits donor effects following anneals in the temperature range ~700–900 °C. Hall–effect measurements performed as a function of temperature indicate that nitrogen in silicon has an ionization energy of 0.017±0.002 eV. Room–temperature Hall–effect measurements combined with stripping techniques have shown that the distribution of electrically active nitrogen is constant as a function of implantation depth. These results are believed to be due to a donor (substitutional) position involving <1% of the implanted nitrogen ions; this interpretation is consistent with the lattice location and damage results presented in Paper I. (auth)

12141 CARRIER CONCENTRATION RATIO AND HALL MOBILITY OF SEMI–INSULATING GaAs UPON PHOTOEXCITATION AND ELECTRON BOMBARDMENT. Euthymiou, P.C.; Nomicos, C.D.; Theodorou, D.E. (Department of Physics, Athens University, Athens, Greece). J. Appl. Phys. 46: No. 1, 449-451 (Jan 1975).

The electron–hole concentration ratio (c) and the Hall mobility (μ_H) of Cr–doped semi–insulating p–type GaAs crystals were investigated as a function of illumination intensity (I), before and after bombardment with $^{90}Sr-^{90}Y$ β^- particles. The quantities c and μ_H were determined by using photomagnetoresistance and photo–Hall measurements at room temperature. The ratio c as a function of I shows a minimum due to the action of traps. Bombardment with β^- particles introduces new trapping levels resulting in a marked change of the ordinate of the minimum. (auth)

12142 ANNIHILATION OF POSITRONS IN QUARTZ AND QUARTZ GLASS IRRADIATED BY FAST NEUTRONS. Bartenev, G.M.; Gorbachev, V.V.; Tsyganov, A.D. (V. I. Lenin Moscow State Pedagogical Institute). Sov. Phys.–Solid State 16: No. 6, 1184-1185 (Dec 1974).

In the present study we continue the investigation of structural damage in silica, occuring during irradiation by a beam of fast neutrons. Samples of synthetic quartz and KI glass were irradiated in the dose range $10^{16}-10^{20}$ b/cm². To decrease the formation of thermal peaks the samples were cooled by a helium flow. The gas temperature was controlled by thermocouples and was approximately 33°K. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstracts 10516, 10537, 10605, and 13145.

12143 (BNWL-1852) EXAMPLE OF VERIFICATION AND ACCEPTANCE OF OPERATOR DATA: LOW-ENRICHED URANIUM FABRICATION. Hough, C. G.; Schneider, R. A.; Stewart, K. B.; Jaech, J. L.; Bennett, C. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1974. Contract AT(45-1)-1830. 121p. Dep. NTIS $5.45.

The purpose of this example is to demonstrate the application of statistical methods to the planning of inspection activities and evaluation of inspection results for a hypothetical fabrication plant. The example concentrates on the statistical aspects of test criteria, sample plans, data collection, acceptance testing, MUF evaluation and statements of results and conclusions of ispections. Thus, the effects of containment and surveillance inspection activities and complexities in inspection introduced by the operator's system of scheduling of receipts and shipments, incomplete measurements and by-difference accounting are not included. The example is based on data and statistical methods given in referenced material, and represents an attempt to adapt the methods of the references to IAEA inspection activities that might be used in connection with the NPT. The report is structured by first presenting a description of inspection objectives. For each of the various objectives a description is given of the statistical concept or approach to be applied for each phase of the inspection activity. The conceptual basis for sampling plans, data evaluation and probability statements is described. Following the conceptual parts, the various statistical methods are applied to the inspection of the hypothetical fabrication plant. Results are given in terms of sample sizes, probabilities of detection, and confidence intervals. For the most part, sufficient explanation of the various formulas and equations is given. (TFD)

12144 (BNWL-SA-5043) METHODOLOGY FOR COPING WITH SABOTAGE AND DIVERSION AT COMMERCIAL NUCLEAR FACILITIES. Clark, R. G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-1830. 17p. (CONF-741086-3). Dep. NTIS $4.00.

From American Nuclear Society national meeting; Washington, District of Columbia, USA (27 Oct 1974).

Coping successfully with sabotage and diversion of special nuclear materials at commercial nuclear facilities can be accomplished, using modern analytical methods and instrumentation systems. Indeed, analytical methods and hardware systems that can provide sophisticated and reliable security already exist; this review is in support of their application. The methodology consists of two parts: First, utilize safety tree analysis and submit the logic to a computer for simulation. Recently-developed and tested computer programs are available to provide extensive and penetrating analyses of the logic submitted from safety trees. System models are developed to use simulate "black hat" team activities prior to actual physical penetration attempts. Second, implement a hardware system of modern instrumentation and surveillance devices coupled to a small computer supported by effective software programming. Recent experience has shown such a system to be effective and to essentially eliminate the need for armed guards inside large commercial facilities. (auth)

12145 (CONF-741026-5) DETERMINATION OF THE PLUTONIUM CONTENT IN SOLID-WASTE DRUMS EXPERIENCE GAINED AT THE PLUTONIUM-CONTAINING FUEL ELEMENT FABRICATION PLANT. Arnal, T.; Ganivet, M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 – Saint-Paul-les-Durance (France)). 1974. Translation of French Report. 14p. Dep. NTIS $4.00.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

The problem of increasing generation of solid wastes which must be stored or reprocessed is presented; the composition of the Pu isotopes and matrix in 100-liter drums are usually not sufficiently well-known. The results of gamma spectroscopy (NaI crystal) measurements are compared with those obtained by chemical analysis after leaching the same wastes. A new facility which combines a Ge(Li) gamma spectrometer and a neutron detector assembly is described. It is expected that the accuracy and sensitivity at low concentrations in fissionable materials will be considerably improved. (auth)

12146 (K-1839(Pt.4)) BEHAVIOR OF THE MINOR URANIUM ISOTOPES IN SEPARATION CASCADES. Part IV. Special Topics: A. The Effect of the Magnitude of the Separation Factor. B. The Effect of Process Gas Losses. C. The Effect of Cascade Non-Ideality. Blumkin, S.; Von Halle, E. (Oak Ridge Gaseous Diffusion Plant, Tenn. (USA)). 18 Dec 1974. Contract W-7405-eng-26. 57p. Dep. NTIS $5.45.

This is the fourth part of a study directed at assessing the usefulness of determinations of the concentrations of the minor uranium isotopes ^{234}U and ^{236}U in cascade feed and withdrawal streams as a complementary safeguards technique for ^{235}U enrichment plants. Three relevant special topics are discussed. The first topic deals with the effect of the magnitude of the $^{235}U/^{238}U$ separation factor on the minor isotope concentrations relative to that of ^{235}U in enrichment cascade withdrawal streams. The second topic deals with the effect of process gas losses that are uniformly distributed along the cascade on the minor isotope behavior. The third topic deals with the question of the importance of knowing the actual cascade design in using the minor isotope concentrations in cascade withdrawal streams as a safeguard technique. (TFD)

12147 (KFK-1980) ANNUAL REPORT, 1973. Bork, G. (comp.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Spaltstoffflusskontrolle). Oct 1974. 159p. (In German). Dep. NTIS (U. S. Sales Only) $11.00.

This report is a description of major activities performed in 1973 within the framework of the Nuclear Safeguards Project by the institutes of the Gesellschaft für Kernforschung Karlsruhe participating in this Project, the European Institute of Transuranium Elements, some industrial firms and the Technical University of Hannover. (auth)

12148 (LA-UR-74-1231) AUTOMATED NONDESTRUCTIVE ASSAY INSTRUMENTATION FOR NUCLEAR MATERIALS SAFEGUARDS. East, L. V.; Martin, E. R.; Atwell, T. L.; Augustson, R. H.; Menlove, H. O. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 7p. (CONF-741212-1). Dep. NTIS $4.00.

From 14th scintillation and semiconductor symposium; Washington, District of Columbia, USA (11 Dec 1974).

Four systems developed at the Los Alamos Scientific Laboratory for nondestructive analysis of nuclear fuel materials are briefly described. These systems utilize either minicomputers or a programmable calculator for measurement control and data analysis, and are typical of a variety of automated measurement systems developed for nuclear materials safeguards applications. (auth)

12149 PRACTICAL APPLICATIONS OF RESEARCH AND DEVELOPMENT IN NUCLEAR SAFEGUARDS. A Report on an Esarda Symposium. Clauss, J. (Energie-Versorgung Schwaben A. G., Stuttgart (F. R. Germany)). At. Strom; 20: No. 7/8, 85-88 (Jul 1974). (In German).

From Esarda symposium; Rome, Italy (7 Mar 1974). 17 refs.

A report on an Esarda symposium in Rome, 7th to 8th of March 1974 is given. The symposium aimed at instructing all interested circles from research, industry and power generation on the progress which had in the meantime been made in developing practical methods for use in safeguards. As is known, in order to carry out the nonproliferation treaty, methods will be introduced all over the world for the control of the flow of fissile materials, so as to ensure the peaceful use of nuclear energy. The Esarda group deals in particular with development and research in nuclear safeguards in Europe and within the EC. (auth)

12150 DELAYED NEUTRON TECHNIQUE FOR USE IN COMPUTER-CONTROLLED NON-DESTRUCTIVE DETERMINATION OF FISSILE MATERIAL IN REACTOR FUEL ELEMENTS. Eberle, R. (Technische Univ. Hannover (F. R. Germany). Inst. fuer Kerntechnik). Atomkernenergie; 24: No. 1, 25-30(1974). (In German).

8 figs.; 1 tab.; 8 refs.

Delayed neutron technique is the base of the concept for an automatic computer-controlled set-up established for the nondestructive assay of fissile material. The determinations are made relatively to a reference element. The apparatus can easily be adapted to various types of elements. There are some theoretical and experimental studies on the optimization of the delayed neutron yield under the restrictions of a preset total time available. The set-up gives a demonstration of its capability when it runs—as an example—on a series of spherical elements for the AVR-reactor. The value of the ^{235}U content of each pebble (approximately equal to 1 g) was determined within ± 4.3% and recorded in a total of 30 s; the statistical error of the total throughput of ^{235}U in a series of 450 elements was ± 0.2%. (auth)

Disposal and Storage

Refer also to abstracts 10817, 10818, 10825, 11246, 11260, 11281, and 11287.

12151 (ARH-SA-206) HANFORD WASTE MANAGEMENT PROGRAM. Shaw, H. P. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1 Nov 1974. Contract AT(45-1)-2130. 35p. (CONF-741129-1). Dep. NTIS $4.75.

From annual meeting of the Pacific Northwest Pollution Control Association; Richland, Washington, USA (6 Nov 1974).

An overview of waste management at the Hanford Works is presented. Processing, storage, and disposal of gaseous, liquid, and solid wastes are discussed. (TFD)

12152 (ARH-ST-110-A) WASTE MANAGEMENT AND TRANSPORTATION TECHNOLOGY DEVELOPMENT QUARTERLY REPORT, JULY 1974 THROUGH SEPTEMBER 1974. Campbell, M. H.; Kupfer, M. J. (ed.). (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Nov 1974. Contract AT(45-1)-2130. 122p. Dep. NTIS $5.45.

This document is the first in a series of quarterly progress reports on activities in support of long-term management of Hanford high-level waste. A variety of specific topics are discussed in some technical depth. These topics can be grouped in the areas of: salt cake retrieval, tank reliability, equipment decommissioning, and increased waste immobilization. (auth)

12153 (BNWL-1779) HANFORD WASTE DISPOSAL SUMMARY, 1972. Soehnlein, J. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1974. Contract AT(45-1)-1830. 15p. Dep. NTIS $4.00.

This is the sixth summary report of Hanford Waste Disposal experience as required by the AEC Manual, RL Appendix 0510, "Waste Disposal". This report has been compiled from data furnished by four Hanford contractors. The most recent summary report is listed in the reference section along with other references used to compile this report. The purpose of this report is to provide a single summary of waste quantities disposed of at Hanford. All averages for waste release measurement were within 10% of RL Appendix 0510 Release Guides. Environmental measurements also demonstrated compliance with applicable environmental standards. Releases of radionuclides to air and water from 100 Area and 200 Area facilities continued to show a downward trend, from previous years reflecting the effects of production facility retirement and the results of programs aimed at reducing releases. The apparent exceptions of tritium and argon-41 are due to relaxation of classification and requirements on tritium releases and the inclusion in reporting requirements of reactor-produced noble gases. (auth)

12154 (CONF-741026-6) MANAGEMENT OF PLUTONIUM-CONTAMINATED SOLID WASTES AT THE CADARACHE CENTER. Mery, J.; Marcaillou, J. (CEA Centre d'Etudes Nucleaires de Cadarache, 13-Saint-Paul-les-Durance (France)). 1974. Translated from French. 22p. Dep. NTIS $4.25.

From seminar on the management of plutonium-contaminated solid wastes; Marcoule, France (14 Oct 1974).

The current procedures for handling plutonium-bearing wastes collected at the plutonium-base fuel fabrication plant are described. The methods used include compaction, incineration, and storage. (TFD)

12155 (REG/G-3.23(11-74)) STABILIZATION OF URANIUM-THORIUM MILLING WASTE RETENTION SYSTEMS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Nov 1974. 2p. DRS Free.

This regulatory guide describes the principal stabilization, maintenance, and long-term control criteria acceptable to the Regulatory staff that should be considered in connection with the construction and use of tailings retention systems at uranium and thorium mills containing radioactive materials in concentrations exceeding those specified in Appendix B of 10 CFR Part 20. (TFD)

12156 (REG/G-3.24(12-74)) GUIDANCE ON THE LICENSE APPLICATION, SITING, DESIGN, AND PLANT PROTECTION FOR AN INDEPENDENT SPENT FUEL STORAGE INSTALLATION. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 13p. DRS Free.

An "independent spent fuel storage installation" (ISFSI) is a self-contained installation for storing spent fuel. It has its own support services and operates independently on any other facility; i.e., it is not a part of either a nuclear power plant or a fuel reprocessing plant. Such an installation is visualized as being capable of storing 1000 tons or more of spent light-water reactor fuel. This guide discusses the license application, site evaluation, design, and plant protection of an ISFSI. It describes the measures acceptable to the Regulatory staff for meeting the requirements of 10 CFR Part 70. In addition, it identifies the information needed by the staff in its evaluation of an ISFSI application. (TFD)

12157 MANAGEMENT OF WASTES FROM REPROCESSING OF IRRADIATED NUCLEAR FUEL. Krylova, N. V.; Kulichenko, V. V. At. Tekh. Rubezhom; 2: 37-46(Feb 1974). (In Russian).

A review is presented of the different methods of management of radioactive wastes arising from the reprocessing of nuclear fuels. Methods of localization of gaseous radioisotopes, management of liquid highly active wastes, technological processes for the solidification of highly active wastes are described. Data on the development of different methods of burial of solidified wastes are given. (tr-auth)

Handling Equipment and Procedures

Refer also to abstracts 11556 and 13285.

12158 (GU-5314) SHIPPING OF PLUTONIUM DIOXIDE POWDER AND MIXED-OXIDE FUEL RODS. Washington, C. E. (Gulf Nuclear Fuels Co., Elmsford, N. Y. (USA)). May 1974. Contract AT(11-1)-2210. 31p. Dep. NTIS $4.75.

The shipping of raw and fabricated plutonium-bearing materials for performance evaluation of Dresden 1 Plutonium Recycle Demonstration Program is described. (TFD)

12159 (ORNL-TM-4767) CRITICALITY CALCULATIONS FOR $PuO_2-UO_2-H_2O$ MIXTURES USING ENDF/B VERSION III CROSS SECTION DATA AND 123 GROUP XSDRN TRANSPORT CODE. Magnuson, D. W. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 14p. Dep. NTIS $4.00.

Criticality calculations for $PuO_2-UO_2-H_2O$ mixtures are given in tabular form. Three ranges of Pu isotopic concentration were used. They are: (1) 100 wt % ^{239}Pu; (2) 79 wt % ^{239}Pu, 15 wt % ^{240}Pu, 6 wt % ^{241}Pu; and (3) 60 wt % ^{239}Pu, 25 wt % ^{240}Pu, 15 wt % ^{241}Pu. The range of Pu/(Pu + U) is covered in fine discrete steps: 1.0, 0.30, 0.15, 0.08, and 0.03. The densities of $^{239}PuO_2$ and $U(nat)O_2$ were 11.46 and 10.96 g/cm^2, respectively. (TFD)

12160 (REG/G-8.12(12-74)) CRITICALITY ACCIDENT ALARM SYSTEMS. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Dec 1974. 2p. DRS Free.

Section 70.24 of 10 CFR Part 70, "Special Nuclear Material," requires licensees who may possess special nuclear material in excess of certain amounts to maintain a criticality accident alarm system. This guide describes a system acceptable to the Regulatory staff for meeting the Commission's requirements for a criticality accident alarm system. (auth)

12161 LOADING PROCEDURES FOR SHIPMENT OF IRRADIATED FUEL. Bates, E. F.; Feltz, D. E.; Sandel, P. S.; Schoenbucher, B. (Texas A and M Univ., College Station). pp 1.72-1.74 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The Nuclear Science Center at Texas A&M does not have proper equipment and facilities for transferring irradiated fuel from the reactor pool to the transport vehicle. To accomplish the transfer of 23 MTR-type fuel elements, procedures were developed using a modified fork lift and flex-lift obtained locally. The transfer was accomplished without incident and with negligible personnel exposure. (auth)

12162 RADIOACTIVE WASTE FILTER REMOVAL SYSTEM. White, D. P. (to Gilbert Associates, Inc.). US Patent 3,838,289. 24 Sep 1974. Filed date 29 Aug 1972. 4p.

A radioactive waste filter cartridge removal apparatus is described that is comprised of a shielding cask having removable top and bottom lids and a support collar integrally secured to the outer wall of the cask for support on a shouldered and shimmed support. Two lowering assemblies comprising rods extending vertically through said support collar at diametrically opposite sides of the cask are provided for effecting lowering movements of the bottom lid. One of said rods has its lower end welded to the peripheral portion of the bottom lid whereby such lid may be rotated about the axis of the rod and thus clear the bottom opening of the cask to permit vertical downward movement of the filter cartridge through such opening. A grappling tool and viewer are mounted on the top lid. (Official Gazette)

12163 HANDLING SYSTEM FOR NUCLEAR FUEL ASSEMBLIES. Renaux, C. (to Commissariat a l'Energie Atomique). US Patent 3,848,423. 19 Nov 1974. Priority Date 9 Feb 1971, France. 4p.

The invention relates to a handling system for nuclear fuel assemblies. The system comprises a trough on the base of a tank which is filled with sodium. The trough is open at its top and has a seating for receiving a fuel assembly. The system also includes a bell-shaped member which is open at the bottom and is provided with means for temporarily locking the bell-shaped member to the trough in a position over the fuel assembly. A U-tube connects the closed top of the bell-shaped member to the exterior and the trough is provided with a siphon device for emptying the trough. (Official Gazette)

12164 NUCLEAR FUEL HANDLING POWDER CONTAINER. Frye, J. A.; Morton, R. B. (to The Boardman Co.). US Patent 3,840,155. 8 Oct 1974. Filed Date 18 Apr 1972. 6p.

A nuclear fuel handling powder container especially suitable for conveying nuclear fuel in powder form consisting of air-tight vacuum load/unload containers used in an overhead rail system and incorporating structure and means for inducing the extremely heavy and active powdered metal to flow from the container is described. A discharge hopper is incorporated which virtually eliminates any bridging or plugging beneath an aerating vane which serves as a feeder vane for the material and means are provided to prevent atmospheric air from entering or dust from leaving the container while vacuum lines for loading or unloading the container are being attached or withdrawn. (Official Gazette)

Transportation

12165 (TID-26698) SAFETY ANALYSIS REPORT ON THE SNAP-27 GROUND SHIPPING CASK. (Battelle Columbus Labs., Ohio (USA)). 3 Feb 1967. 121p. Dep. NTIS $9.25.

A safety evaluation of the design of the SNAP-27 Ground Shipping Cask developed by Battelle Memorial Institute for General Electric Company, Missiles and Space Division is presented. The purpose of the cask is to transport a single SNAP-27 fuel capsule assembly by common carrier. It is the purpose of this report to show that the cask and its components are designed to meet and surpass the design requirements of General Electric Company Specification NS 0110-07-02-B, AEC Regulations 10 CFR 71 and 10 CFR 72, and ICC Regulations 47 CFR 71-78. (auth)

12166 AMERICIUM–CURIUM SHIPPING CARRIER ASSEMBLY (31 MAR 1970) (ENGINEERING MATERIALS). (Oak Ridge National Lab., Tenn. (USA)). (CAPE–2397).

2 drawings.

12167 MARITIME TRAFFIC. Preliminary Remarks. 6. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C4. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).

Some preliminary remarks have been added to the maritime traffic regulations. (GE)

12168 INTERNATIONAL CONTRACT ON SHIP SECURITY OF JUNE 17th, 1960. 1960 International Convention for the Safety of Life at Sea (Annex A) (Excerpt). 6. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C42. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

An excerpt from SOLAS convention has been included. (GE)

12169 PACKAGING FOR THE TRANSPORTATION OF RADIOACTIVE MATERIALS. Blum, P. (to Transnucleaire, Societe Pour Les Transports De L'Industries). US Patent 3,845,315. 29 Oct 1974. Priority Date 17 Nov 1970, France. 12p.

The packaging is comprised from easily demountable and replaceable components, including a fluid-tight capsule for containing the radioactive materials, a liquid or gaseous coolant, a gamma ray shield and an outer pressure vessel. The latter has cooling elements on its lateral surface and contains a fluid capable of ensuring neutronic protection and evacuation of heat. The capsule and gamma ray shield are immersed in the fluid. The dimensions of the various components are such that the thickness of the fluid layer between the gamma ray shield and the outer pressure vessel provides adequate neutronic protection. Spacers maintain the components in position. A compressible material may be included in compartments between the outer container and the gamma ray shield. (Official Gazette)

12170 RADIATION RESISTANT CONTAINER. Tureck, A. US Patent 3,845,316. 29 Oct 1974. Filed Date 21 Mar 1973. 4p.

A radiation resistant container fabricated from sheets of different materials laminated together with at least one of said sheets being impervious to radiation is described. The laminated sheets can be used to line a permanent type of container or to fabricate a throw-away type of container. (Official Gazette)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 11342, 11376, and 12930.

12171 (AECL-4512) UPGRADING OF THE CRNL MP TANDEM FOR 13 MeV OPERATION. Burn, N.; McDonald, A. B.; Andrews, H. P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Dec 1973. 41p. INIS.

The Chalk River MP Tandem accelerator has been upgraded from 10 MV to 13 MV operation by the installation of new resistors and a set of high-gradient stainless-steel electrode accelerating tubes manufactured by High Voltage Engineering Corporation. Without tubes, the column structure of the accelerator was tested at voltages up to 16 MV using SF_6 at 90 psig (0.71 MN/m^2) as insulating gas. The most important requirement for this high voltage operation was the elimination of dust and larger fragments of the belt falling from the column; the insulating gas pressure was not critical. Oxygen appeared unsuitable as a stripper gas, to be pumped irreversibly by the new tubes and to result in unstable operation. Nitrogen gas is a satisfactory substitute. The transmission of the new tubes is 40 to 50% for protons and oxygen from a low emittance direct extraction duoplasmatron or from a Heinicke-Penning source. Operation at 13 MV for long periods has been achieved for a variety of ions with as few as two voltage breakdowns per 24 hours. Conditioning and operating procedures are described. (auth)

12172 (ANU-P-580) OPENING OF THE NEW NUCLEAR STRUCTURE FACILITY INCLUDING THE 14UD PELLETRON ACCELERATOR. (Australian National Univ., Canberra. Research School of Physical Sciences). 1973. 15p. INIS.

Remarks by the director of the Research School of Physical Sciences, the president of the National Electrostatics Corporation, and the Australian Prime Minister are included. A brief description of the accelerator development at ANU is given. (INIS)

12173 (CONF-741040-6) RECENT TRENDS IN PARTICLE ACCELERATOR RADIATION SAFETY. Ohnesorge, W. F.; Butler, H. M. (Oak Ridge National Lab., Tenn. (USA)). 1974. 6p. Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

The use of particle accelerators in both applied and research activities continues to expand. This expansion brings new machines with higher energy and current capabilities and introduces radiation safety problems not commonly encountered before. An overview of these increased ionizing radiation hazards is given along with a discussion of some of the new techniques required in evaluating and/or controlling them. The ORNL Health Physics Information Center aided in a computer search of the literature; hence, a relatively comprehensive reference to publications describing accelerator radiation safety problems and related subjects is included. (31 references) (auth)

12174 (CONF-741112-2) STATUS OF THE FERMILAB 400-GeV ACCELERATOR. Reardon, P. J. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). [nd]. 19p. Dep. NTIS $4.00.

From 4th all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The layout and operation of the Fermilab accelerator are summarized, and plans for the future are discussed, including the Energy Doubler and the POPAE (Protons On Protons and Electrons) storage rings. (WHK)

12175 (INIS-mf-1394) ANNUAL REPORT OF NUCLEAR PHYSICS GROUP, 1 JAN 1973–31 DEC 1973. (Auckland Univ. (New Zealand). Dept. of Physics). Mar 1974. 10p. INIS.

This report is the first of what is hoped will be annual reports describing work in progress and completed during the year. The intention is to cover the experimental programme using facilities at Auckland and work undertaken by members of the group at other laboratories. The major development in 1973 was the rebuilding of the Polarized Ion Source as a positive ion machine and its first use in a measurement. The source behaved reliably and preparation is well advanced for an extensive experimental programme based on the polarized neutrons it has made available. AURA II, our up and down Tandem Electrostatic Accelerator, continued to give good service up to 5 MeV. Performance and stability have been disappointing at higher voltages, and strenuous efforts are being made to improve them for energies up to 6.4 MeV. A lithium charge exchange ion source for AURA II was ordered and is due for delivery in March 1974. This will enable us to accelerate beams of ^6Li, ^7Li, ^3He and ^4He. Major detector purchases included a 10% Ge(Li) gamma ray spectrometer and a position-sensitive detector for use in the Enge magnetic spectrometer. The current experimental programme includes study of the elastic scattering of polarized neutrons from protons and deuterons, high-precision investigations of weak interaction phenomena and nuclear spectroscopy studies. The latter include gamma spectroscopy with heavy ions undertaken in collaboration with groups at Brookhaven National Laboratory and State University of New York at Stony Brook. (INIS)

12176 (INIS-mf-1564) POSSIBLE APPLICATIONS OF A 28 MeV CYCLOTRON. da Silva, A. G.; Auler, L. T. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). [nd]. 69p. (In Portuguese). INIS.

The possibilities of applied work that can be done with a multiparticle variable energy cyclotron have been compiled. The characteristics of the 28 MeV cyclotron facility are described. Radioisotope production, neutron production cross sections, radiation damage, and charged particles and fast neutron activation analysis are discussed. (INIS)

12177 (LA-UR-74-1448) LAMPF PROTON LINAC PERFORMANCE. Jameson, R. A. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 14p. (CONF-741112-3). Dep. NTIS $4.00.

From 4th all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The present status of work directed toward bringing the LAMPF proton linear accelerator to design intensity and accelerating both H^+ and H^- beams simultaneously is described. An overview of the performance is given, and then the transverse and longitudinal phase space investigations are covered in more detail, covering the techniques used for measurement, the results to date, and discussion of the work remaining. The program for measuring and improving long-term stability and reliability of the accelerator facility is briefly described. (auth)

12178 IMPROVEMENTS TO CYCLOTRON PARTICLE ACCELERATORS. Leboutet, H.; Aucouturier, J.; Levaillant, C.; Pontvianne, J. (to Thomson-CSF). French Patent 2,176,485. 20 Mar 1972. 9p. (In French).

The invention relates to cyclotrons comprising means for generating an electric field adapted to accelerate particles issuing from a particle source located at the center of the cyclotron, means adapted to generate a magnetic field for deflecting said particles and a magnetic circuit defining an operative space in which the particles follow their acceleration paths, characterized in that said operatives space is vacuum sealed by means of plates located on both sides of the magnetic circuit and directly applied against the latter said operative space, thus forming the cyclotron vacuum box. (FR)

12179 IMPROVEMENTS TO LINEAR ACCELERATORS WITH LIMITED ENERGY AND IRRADIATION MEDICAL DEVICES MAKING USE OF SUCH ACCELERATORS. Azam, G. (to Thomson-CSF). French Patent 2,176,505. 21 Mar 1972. 7p. (In French).

The linear accelerator according to the invention comprises a plurality of resonant cavities separated from one another by iris diaphragms, the dimensions of which determine the internal impedance of the accelerating structure constituted by said cavities so that the beam energy is always lower than a predetermined value. The improvement according to the invention is specially suitable for the medical field. (FR)

12180 ADVANCES IN THE EFFICIENT GENERATION OF INTENSE PULSED PROTON BEAMS. Humphries, S. Jr.; Lee, J.J.; Sudan, R.N. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14850). J. Appl. Phys. 46: No. 1, 187-192 (Jan 1975).

Recent studies on the space–charge–limited reflex vacuum triode pulsed ion accelerator show a marked improvement in the output parameters and efficiency of the device. In the current machine, a 50–nsec pulse of 130–keV protons of 6000 A is produced at a current density of 20 A/cm^2. Energies up to 300 keV have been investigated. The triode efficiency, defined as proton energy output versus total energy input, has been raised from 10 to 42% by the addition of magnetic fields that prevent anomalous electron loss in the fringing fields at the edges of the electrodes. Time–of–flight measurements confirmed the peak energies. The beam was measured to have about a 10 ° half–angle of spread. The results obtained indicate that the

accelerator may be scaled to the ranges of parameters currently achieved by pulsed electron accelerators. (auth)

12181 INTRODUCTORY DESCRIPTION OF THE NEW ELECTROSTATIC ACCELERATOR LABORATORY OF THE ATOMKI. Koltay, E.; Szalay, A. ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 3, 181-191(1974).

The design, construction, operation, and performance of the 5-MeV Van de Graaff accelerator facility are outlined. (WHK)

12182 PARTICLE ACCELERATOR PRODUCING A UNIFORMLY EXPANDED PARTICLE BEAM OF UNIFORM CROSS-SECTIONED DENSITY. Allison, R. W. Jr. (to Texas Instruments Inc.). US Patent 3,845,312. 29 Oct 1974. Filed date 13 Jul 1972. 8p.

A particle accelerator is described that is useful for ion implantation using a high density ion source. The accelerator is provided with a means for increasing the cross-sectional area of the beam, a means for modifying the cross-sectional density of the beam to achieve a uniform particle density at the target area, and a means for modifying particle trajectories and target holder so that the particles strike the substrate with a directed angle within 4° of parallel when they strike the plane of the target area. (Official Gazette)

Auxiliaries and Components

Refer also to abstract 11360.

12183 (ANL-Trans-962) PRELIMINARY CALCULATIONS OF THE MAIN GEPHYROTRON AND ITS POWER SUPPLY. Ciret, J. C.; Devailly, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). Nov 1974. Translation of GERMA-74-101/IE.11. 15p. Dep. NTIS $4.00.

The preliminary design of the toroidal winding and power input program for the main gephyrotron for the Saturne synchrotron is described. (WHK)

12184 (BARC-721) MATERIAL TESTING FOR SWITCHING MAGNET. I. Nambiar, K. B.; Thomas, P. V.; Divatia, A. S. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

A switching magnet which is capable of bending a charged particle beam through an angle (maximum) of 50° is being built for the Variable Energy Cyclotron Project. Low carbon content steel was used for the fabrication of the magnet frame, and the energizing coils are made of hollow aluminium. The magnet forms one of the major elements in the beam transport system. It is housed in the vault area where high neutron and gamma radiation is present during machine operation. Therefore, it is imperative that the materials used in the fabrication and assembly of the magnet be thoroughly tested for the specific requirements. Results of neutron damage studies on the electrical properties of the insulation are presented. (WHK)

12185 (BNWL-19322) OPERATING EXPERIENCE WITH A SUPERCONDUCTING MAGNET IN A PRIMARY PROTON BEAM. Allinger, J.; Danby, G.; DeVito, B.; Hsieh, S.; Jackson, J.; Prodell, A. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 4p. (CONF-740957-28). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Two superconducting dipole magnet modules have been operated successfully at BNL since October 1973 to bend 30 GeV/c protons from the AGS by 8° in the new North Area beam to the 7-ft Bubble Chamber. The magnets have been energized for over 1000 hours, and, of that time, have been traversed by the proton beam with beam intensities up to 5×10^{12} protons per pulse, for about 750 hours. Operation of these series connected magnet units, each 2 meters long at 35 kG has been routine even when they were intermittently subjected to beam heating of several hundred joules per pulse due to other operational beam difficulties. Experiments were also performed where copper blocks were inserted 2 meters upstream, resulting in very large interation rates in the beam tube inside the units. A magnet quench occurred with target thicknesses such that energy approaching 1 kJ per pulse was being absorbed in the system. These are the first superconducting magnets in operation in a primary beam on which extensive radiation heating tests have been performed. (auth)

12186 (BNL-19513) EDDY CURRENT EFFECTS IN THE ISA VACUUM CHAMBER. Herrera, J. C. (Brookhaven National Lab., Upton, N. Y. (USA)). 4 Dec 1974. 7p. Dep. NTIS $4.00.

The eddy current effects associated with a changing magnetic multipole field applied to a thin-wall cylindrical chamber are studied in some detail. The results are specialized to the ISABELLE vacuum envelope and the power loss, the time constant, and the multipole field perturbation within the chamber are obtained. (auth)

12187 (INIS-mf-1518) NMR-CONTROLLER FOR ANALYZING MAGNET OF VAN DE GRAAF ACCELERATOR. Starkey, J. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). 13 Nov 1972. 44p. INIS.

The apparatus described in this handbook is used to control the field strength of the deflecting or "analyzing" magnet of the Van de Graaff accelerator. Nuclear Magnetic Resonance (NMR) methods are used to sense the strength of the field. Several instruments are unified in a closed loop control system, enabling the operator to automatically select the magnet field strength in terms of the corresponding proton NMR frequency. Essentially two steps are involved in setting the field strength: 1) the NMR oscillator is tuned to the desired frequency, and 2) the magnet current is adjusted until the resonance condition is achieved. These procedures are fully automated, and once resonance is established, the magnet current is controlled to nullify any drift or disturbing effects. Furthermore the frequency is derived directly from a high stability quartz crystal oscillator, and this serves as the reference on which the field strength is stabilized. (INIS)

12188 (JINR-9-7318) PULSED CURRENT SOURCE WITH PROGRAM CONTROL FOR THE "N" CORRECTION IN SYNCHROPHASOTRON. Voevodin, M. A.; Korukov, N. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 11p. (In Russian). INIS.

A current source with programmed control, developed and fabricated in the synchrophasotron section, is described. It was designed for the correction of the magnetic field of the synchrophasotron at low induction. The current rise was graduated. The source makes it possible to control within wide limits the current rise and magnitude in the correction windings. The circuit was designed basically in 4-layer semiconductor elements. (tr-auth)

12189 (JINR-P16-8179) EXPERIMENTAL VERIFICATION OF THE METHOD OF CALCULATION OF THE SHIELDING OF PROTON ACCELERATORS. Aleinikov, V. E.; Komochkov, M. M.; Kryuchkov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 17p. (In Russian). (CONF-741112-7). Dep. NTIS (US Sales Only) $4.00.

From 4th all-union national conference on charged particle accelerators; Moscow, USSR (18 Nov 1974).

The measured and calculated parameters of the radiation behind a concrete shield placed behind the absorber of the 660-MeV proton beam were compared. The ratio of the calculated and measured values does not exceed 3 in the majority of cases. (tr-auth)

12190 (LA-5766-MS) BRAZE WELD JOINTS FOR VACUUM SYSTEM ASSEMBLIES. Clayton, R. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 5p. Dep. NTIS $4.00.

A method of tungsten inert gas (TIG) welding using brazing alloys has been developed, which has particular utility for vacuum system assemblies. The technique is presented as a suitable alternative to other procedures for certain applications. Experience with this technique on LAMPF linac components is discussed. (auth)

12191 IMPROVEMENTS TO MAGNETIC DEFLECTION SYSTEMS AND ACCELERATORS PROVIDED WITH SUCH SYSTEMS. Leboutet, H.; Aucouturier, J. (to Thomson-CSF). French Patent 2,175,676. 17 Mar 1972. 8p. (In French).

The improvements forming the object of the invention consist in associating a first system for deflecting a particle beam with a magnetic deflection system which permits an isochronous deflected beam to be obtained. To the focal achromatic deflecting unit D1 which comprises four identical electromagnets is associated a focal achromatic magnetic deflection system which comprises four electromagnets with parallel sides. The specification states the conditions required for rendering the focal achromatic system obtained by associating D_1 and D_2. Such a deflection system can be used whenever it is desired to obtain a deflected system showing the same phase features as the initial beam. (FR)

12192 BT-1004 THYRISTOR REGULATOR FOR KVTMS-T POWER BLOCKS. Omel'chenko, B. D. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 787-789(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 140-142(1974).

The extensive utilization of magnetic elements in charged-particle transport channels (specifically, quadrupole lenses) with an excitation current of several kiloamperes makes promising the use of silicon rectifiers controlled by saturable reactors as

supply sources. Such devices include power blocks of the KVTMS-T series. They are designed for external installation and offer substantial economic and operational advantages over thyristor power rectifiers at currents > 1 to 1.5 kA. A semiconductor regulator is described which has been developed in the high-energy laboratory of the JINR and is designed for joint utilization with power blocks of the KVTMS-T series. The regulator contains a dc amplifier based on an integrated microcircuit, electrical protection that takes into account the specific features of operation of the indicated block in the dc transformer mode and assures stability of the average value of the supply current with an accuracy of at worst ±0.01%. (WHK)

12193 MEASUREMENT OF THE EREVAN SYNCHROTRON PHOTON BEAM POLARIZATION. Avakyan, R. O.; Arutyunyan, L. G.; Vartapetyan, G. A.; Iskandaryan, A. G.; Mirzoyan, R. M.; Elbakyan, G. M. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 3, 252-255(1974). (In Russian).

Making use of the coherent pair production in the diamond crystal, the polarization of a photon beam with 1.5 GeV peak energy was measured. (auth)

Ion Sources and Injection and Extraction Systems

12194 (CONF-741040-2) ION SOURCES FOR ACCELERATORS. Alton, G. D. (Oak Ridge National Lab., Tenn. (USA)). 1974. 30p. Dep. NTIS $4.50.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

A limited review of low charge state positive and negative ion sources suitable for accelerator use is given. A brief discussion is also made of the concepts underlying the formation and extraction of ion beams. Particular emphasis is placed on the technology of ion sources which utilize solid elemental or molecular compounds to produce vapor for the ionization process. (47 references.) (auth)

12195 OPERATION OF A POLARIZED ^3He SOURCE. Karban, O.; Oh, S.; Powell, W.B. (Department of Physics, Unversity of Birmingham, Birmingham B15 2TT, England). Phys. Rev. Lett. 33: No. 24, 1438-1440 (9 Dec 1974).

A source of polarized $^3He^{++}$ particles based on the Lamb shift in $^3He^+$ ions is now operating. After axial injection into a cyclotron and acceleration to 33 MeV, the on—target beam intensity in a scattering chamber exceeds 0.1 nA. Nuclear scattering experiments together with a study of the source characteristics indicate a beam polarization value of $P=0.40\pm0.05$. (auth)

Ion Optics and Field Calculations

Refer also to abstract 13085.

12196 (IFVE-OP-72-94) STRESSES IN PARABOLIC LENSES CIRCULATED BY THE HEAVY ELECTRIC CURRENT. Baratov, D. G.; Valov, V. M.; Rzaev, R. A.; Rykov, V. L.; Shalashov, I. M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 32p. (In Russian). INIS.

The static stress-deformed state of axially symmetrically loaded parabolic current lenses, used as elements of the focusing installation for neutrino channels, was studied. The analysis was made on the basis of an approximate analytical resolution and numerical integration of the equations of the shell theory by the bilateral matrix pass method. The algorithms used can be used for the calculation of any rotation shell of variable thickness. On the basis of the dependence of the maximum equivalent stress on the geometry of the shell and the size of the current, the parameters were determined for lenses having stability reserves in the optical power of the lens and corresponding to the optimum variant of the focusing installation. (tr-auth)

12197 (IFVE-SKU-73-77) BEAM SELF-BUNCHING ONTO MAGNETIC FIELD FLAT-TOP IN THE IHEP ACCELERATOR. Basov, A. I.; Osipov, V. V.; Polyakov, V. V.; Sulygin, I. I.; Shembel, B. K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 9p. (In Russian). INIS.

The results of the experimental study of the beam self-bunching at the magnetic field flat-top in the IHEP accelerator are reported. The effect of this phenomenon on the operation of the system for the slow guidance of the beam to the target was examined. (tr-auth)

12198 LONGITUDINAL INSTABILITY OF A CIRCULATING PROTON BEAM CAUSED BY BEAM-CAVITY INTERACTION. Balbekov, V. I.; Pashkov, P. T. At. Energ. (USSR); 37: No. 4, 332-335(Oct 1974). (In Russian).

A relativistic beam coasting in a proton synchrotron with constant magnetic field and without accelerating voltage is considered. Longitudinal instability arises as a result of beam-cavity interaction and leads to loss of energy and beam bunching. The initial stage of this process (weak bunching) is investigated by the Vlasov equation method. Formulas and diagrams convenient for practical calculation of the instability threshold and increment are given. The next stage (strong bunching) is analyzed numerically. In this stage, bunches circulating on orbits of different radius separate from the beam. Owing to the differences in rotation frequencies, modulation of the induced voltage on the cavities takes place. The calculation results agree closely with experimental data obtained for the IHEP accelerator. (auth)

12199 TRANSFORMATION MODES IN THE RESONATOR OF A DRIFT-TUBE LINEAR ACCELERATOR. Bomko, V. A.; Klyucharev, A. P.; Rudyak, B. I. At. Energ. (USSR); 37: No. 4, 326-331(Oct 1974). (In Russian).

The results of experimental investigation of mode interaction processes of a resonator with the field of a post coupler system are described. Experiments were conducted on an accelerator of heavy ions and models of a drift-tube accelerating structure. One, seven, and twelve conducting posts were located in the cavity radially at an angle of 180° to the drift tube stems. The frequency change for the low edge band models E_{011} versus post length and the process of transformation of frequency and field modes into coupling modes are given. The large variation in coupling coefficients made it possible to use the indicated processes of resonant transformation to solve the problem of stabilizing the accelerating field pattern. Optimal conditions of frequency perturbation compensation are presented. (auth)

12200 SELF-ACCELERATION OF AN ELECTRON BEAM TRANSITTING THROUGH A WAVEGUIDE WITH A LONGITUDINALLY MAGNETIZED FERRITE. Nasonov, N. N.; Shenderovich, A. M. Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 6, 909-913 (1974). (In Russian).

A shock excitation of a cylindrical waveguide with a ferrite by an electron beam transitting along its axis was investigated theoretically. It is shown that after the pulse front of the beam current has passed through the waveguide, a longitudinal hf electric field occurs due to the magnetic moment of the ferrite. Under the influence of the field, a part of the beam particles gets the energy at the expense of other particles. The field is not associated with the Cherenkov radiation since it occurs in a narrow waveguide cut off for all frequencies in the spectrum of the beam current pulse. (auth)

12201 EXPERIMENTAL AND THEORETICAL STUDIES OF THE BEHAVIOR OF AN H- ION BEAM DURING INJECTION AND ACCELERATION IN THE TRIUMF CENTRAL REGION MODEL CYCLOTRON. Root, L. W. Vancouver, B. C.; Univ. of British Columbia (1974). vp. National Library of Canada, Ottawa. Thesis (Ph. D.).

A comparison is made between the experimental and theoretical behavior of the H- beam in the TRIUMF central region cyclotron. The axial injection process and the first six accelerated turns are studied in detail. In order to optimize the cyclotron performance the phase space emittance of the beam at the injection line exit must be matched to the central region acceptances. To this end, a theoretical study was made of the ion optical properties of the injection elements: the magnet bore, the spiral electrostatic inflector, the electrostatic deflector and the first radio-frequency accelerating gap. In many cases these results were confirmed by experimental observations. It was also shown theoretically that by a suitable choice of the accelerating gap, under optimum conditions, 70% of the injected beam can be directed within the radial acceptance and 90% within the vertical acceptances. The effects of a chopper and buncher in the injection line were also measured. A minimum pulse length of approximately 2.5 nsec was obtained with a bunching factor of 3.0. The radial beam diagnostic techniques used for determining proper centring and isochronous operating conditions are discussed. With these techniques it was possible to centre a 30 deg phase interval to within 0.15 in., which was the approximate uncertainty in our measurements. A simplified treatment of radial-longitudinal coupling is given and used to explain qualitatively the behavior of a small emittance beam. The effects of space charge on the first six accelerated turns are calculated. For a beam occupying a phase width of 30 deg, these effects are predicted to be negligible for average accelerated currents below 100 μA. The experimental observations made on high-current beams are described; prior to the shutdown of the cyclotron beams of up to 140 μA average current were accelerated. (Diss. Abstr. Int., B)

12202 ELEKTRONNYE PUCHKI BETARONOV. (Electron Beams of Betatrons). Vorob'ev, A. A.; Kononov, B. A.; Evstigneev, V. V. Moscow; Atomizdat (1974). 152p.

The dynamics of the forming of the electron beam are discussed. All stages of the accelerating cycle of the betatron are examined. The bases for the calculation and the methods of obtaining an extracted electron beam with specific spatial, time, and energy distributions are given. The methods for the construction of different electron detectors for betatrons are reported. (tr-auth)

12203 FIRST-ORDER TREATMENT OF COMBINED EFFECTS OF SPACE CHARGE AND EXTERNAL FIELDS ON PLANE-SYMMETRIC BEAMS OF CHARGED PARTICLES. Bosi, G. (Département de Physique, Université de Moncton, Moncton, New Brunswick, Canada). J. Appl. Phys. 46: No. 1, 183-186 (Jan 1975).

First-order equations describing the space-charge spread of charged particle beams under the influence of plane-symmetric external fields are proposed. The present treatment is confined to elliptic cross-section beams and is based upon an earlier work about axially symmetric systems. (auth)

Storage Rings

12204 (BNL-19381) PRELIMINARY STUDY OF A CERN 400 GeV STORAGE-RING FACILITY. Chasman, R. W.; Garren, A. A.; Johnsen, K.; Keil, E.; Montague, B. W.; Zotter, B. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 10 Sep 1974. 19p. Dep. NTIS $4.00.

The status of the studies at CERN on large proton storage rings is outlined. The physical layout and performance estimates of proposed experimental insertions are discussed. The storage ring parameters are listed. (WHK)

12205 (BNL-19388) EFFECT OF COMMON QUADRUPOLES ON THE MAXIMUM BEAM-BEAM LIMITED LUMINOSITY IN LOW-β INSERTIONS. Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 16 Sep 1974. 11p. Dep. NTIS $4.00.

It is shown that the maximum attainable beam-beam limited luminosity is reduced by allowing the beams to interact electromagnetically in the focusing system. In particular the common quadrupole configuration in the POPAE design for 1 TeV collisions introduces such an interaction and causes a reduction in L_{max} which could be large as a factor of 5. It would appear that, in order to avoid this effect, the design should incorporate a common bending magnet to separate the beams before entering the focusing system. (WHK)

12206 STUDY OF A CRYOPUMP FOR POSSIBLE USE ON THE ISR. Benvenuti, C. (European Organization for Nuclear Research, Geneva). Vide; 28: No. 168, 235-241 (Nov 1973).

From the analysis of the two elementary vacuum systems (long and short magnet regions) which constitute the major part of the ISR and neglecting in first approximation special components of unknown out-gassing rate and irregular distribution, it seems to be possible to achieve in the ISR pressures not higher than about 4.10^{-12} torr by adding a cryopump to each ion pump in the regions of interest. Such a cryopump, here dimensioned both from the vacuum (pumping speed and limit pressure) and from the cryogenic (liquid helium boil-off rate and operational life time) points of view, will help in reducing the background for physics experiments when mounted on the up-stream arms of the intersection regions, and in general, might offer the possibility of increasing the intensities of the circulating beams by reducing beam induced pressure jumps. (FR)

Experimental Facilities

Refer also to abstracts 11387, 11390, 11397, and 11476.

12207 (AD-781959) ION BEAM OPTICAL POLISHING SYSTEM COMPUTER PROGRAMS. Lester, J. D. (Frankford Arsenal, Philadelphia, Pa. (USA)). Nov 1973. 66p. (FA-R-2096). NTIS $3.75.

A low-energy ion beam accelerator system has been developed for fabrication of precision optical elements. This system forms optical surfaces by means of computer controlled sputtering and optical reticles by means of computer controlled implantation. The source language computer programs used to drive the accelerator are listed and described. (auth)

12208 (BNL-19346) BNL MULTIPARTICLE SPECTROMETER AND ITS USE WITH POLARIZED TARGETS. Foley, K. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 16p. (CONF-740673-3). Dep. NTIS $4.00.

From workshop on polarized targets; Upton, L. I., New York, USA (Jun 1974).

The Brookhaven Multiple-Particle Spectrometer (MPS) is a very large solid angle, high resolution spectrometer employing digitized wire spark chambers in a magnetic field. The magnet, detectors, resolution, beams, and trigger system are described. Four approved experiments are listed, and comments on the use of the MPS with polarized targets are given. (WHK)

12209 (BNL-19347) POLARIZED PROTON TARGET FOR THE MPS. Etkin, A.; Lindenbaum, S. J.; Ozaki, S. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 5p. (CONF-740673-2). Dep. NTIS $4.00.

From workshop on polarized targets; Upton, L. I., New York, USA (Jun 1974).

It is proposed to build a polarized proton target which will allow the large acceptance of the BNL multiparticle spectrometer (MPS) to be used effectively. It is planned to build a propanediol frozen spin target approximately 10 cm long by 2 cm square consisting of a polarizing magnet, dilution refrigerator, NMR polarization monitor, polarizing microwave source, and the MPS as the holding magnet. (WHK)

12210 (CONF-741040-4) ACCELERATOR AND NEUTRON TARGETS: A SURVEY. Kobisk, E. H. (Oak Ridge National Lab., Tenn. (USA)). 1974. 23p. Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

Although advances in electronics, ion source physics, detector technology, and other technical aspects of accelerator science have resulted in the capability of making highly sophisticated and accurate measurements of nuclear and atomic properties, it remains a fact that the significance of such measurements is frequently dictated by the form, composition, and other characteristics of the target containing the nuclear species being studied. Consideration must be given to the impurity content, number of isotope nuclei per unit area, uniformity of nuclei distribution in the target, physical strength of the target, and myriad other factors. Most target characteristics are related to the mode(s) of preparation and to the quality of isotopic material used. A wide variety of target types and associated preparative methods together with methods of target characterization are described and evaluated. (auth)

12211 (CONF-741040-8) RADIATION DAMAGE STUDIES WITH ACCELERATORS. Saltmarsh, M. J. (Oak Ridge National Lab., Tenn. (USA)). 1974. 18p. Dep. NTIS $4.00.

From 3rd conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

Radiation damage is one of the major technological problems associated with future reactor development programs. In the hostile environment of a reactor core, drastic changes can occur in the properties of materials in ways which are generally complex and poorly understood. Direct measurement of these effects is difficult. Fission reactors have limited space, and experiments are often long and costly. No fusion reactor is yet available. As a result many laboratories are using accelerators to explore the various facets of radiation damage. The work at Oak Ridge is based mainly on the CN Van de Graaff and the Oak Ridge Isochronous Cyclotron. The program includes the simulation of high fluence neutron damage using heavy ion beams, examination of the effect of 14 MeV neutron bombardment on surfaces, the injection of He into materials to be subsequently irradiated, and various analytical techniques which involve accelerator beams. The experiments are directed not only toward an understanding of the fundamental mechanisms of radiation damage, but also toward development of techniques for rapidly testing the damage resistance of different alloys. (auth)

12212 (IFVE-SKU-72-50) PROTON BEAM PULSE TRANSPORT SYSTEM FOR MIRABELLE BUBBLE CHAMBER. Aseev, A. A.; Afonin, A. G.; Boll, A.; Dehvis, G.; Drozhdin, A. I.; Langezet, B.; Mogen, Zh.; Moizhes, L. L.; Myznikov, K. P.; Pflyum, G.; Tatarenko, V. M.; Tarakanov, N. M.; Fol'ker, F. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1972. 47p. (In Russian). INIS.

The work on the design, construction, and alignment of the pulse system for the transport of the extracted proton beam from the 70-GeV accelerator to the Mirabelle bubble chamber is reported. The characteristics of the system, its calculated parameters, the characteristics of the equipment, and the tolerances are discussed in detail. The methods for adjusting and calibrating the system and apparatus used are described. The results of the tuning of the system are reported. (tr-auth)

12213 (IFVE-SKU-73-78) EFFICIENCY OF INTERNAL TARGETS OF THE IHEP 70 GeV ACCELERATOR. Gridasov,

V. I.; Myznikov, K. P.; Chepegin, V. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 19p. (In Russian). INIS.

The results of studies made on the IHEP in order to select conditions guaranteeing the maximum efficiency of the interaction of the accelerated beam with internal targets are reported. During slow guidance of the beam to the target, the efficiency in the optimum case is more than 90%. Conditions at which the efficiency reaches 30 to 50% can be created during discharge of the beam on target at times up to 1 msec. (tr-auth)

12214 (JINR-10-7889) COMMUNICATION LINE OF SYNCHROPHASOTRON MEASURING CENTER-BESM-4 COMPUTER. Dul'ski, R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. (In Russian). INIS.

The communication lines of the measurement center of the synchrophasotron and the BESM-4 computer were described. The computer was developed using integrated TTL microcircuits and the techniques of the CAMAC system. The system was developed in the High-Energy Laboratory of JINR. (tr-auth)

12215 NEUTRON TUBE FOR RADIATION THERAPY. Reifenschweiler, O. (Philips' Research Labs., Eindhoven, Netherlands); Colditz, J.; van Houwelingen, D. Medicamundi; 19: No. 1, 20-21 (1974).

A sealed neutron tube for producing 14-MeV neutrons at 10^{12} n/sec is described. The tritiated titanium target is self-regenerated by bombarding it with a mixed beam of tritons and deuterons. The performance and experience with the source are outlined. (WHK)

12216 IMPROVEMENTS TO COLLIMATION DEVICES FOR AN ACCELERATED PARTICLE BEAM. Milcamps, J.; Penet, A. (to Thomson-CSF). French Patent 2,175,586. 15 Mar 1972. 7p. (In French).

The collimation device associated with a particle accelerator permits to obtain a homogeneous irradiation beam in a predetermined zone. It comprises a first collimating system of known type constituted by mobile members of which is associated a second collimating system comprising assemblies of metal plates or masks rigidly fixed to supporting members which are integral with said first system. (FR)

12217 DIFFUSION DEVICE FOR OBTAINING HOMOGENEOUS ELECTRON IRRADIATION, PARTICULARLY FOR RADIOTHERAPY APPARATUS. Perraudin, C. (to Thomson-CSF). French Patent 2,173,752. 1 Mar 1972. 10p. (In French).

The device according to the invention for diffusing electrons generated by a particle accelerator comprises a first plate for diffusing the electron beam issuing from the accelerator (the distribution of the irradiation doses on a given field provided by said first plate showing a maximum in the middle portion) and a second diffusion plate mounted down stream of the first one along the electron path, showing a middle portion which is poorly transparent to electrons and a peripheral portion highly transparent to electrons, the interception by the second plate of the middle portion of part of the electrons emitted by the first plate ensuring a fairly constant distribution of irradiation dose on a fairly large field. (FR)

12218 METHOD OF IRRADIATION USING ELECTRON BEAMS. Shimizu, Y. (to Matsushita Electric Industrial Co. Ltd.). Japanese patent 1973-24599/B. 16 Dec 1969. (In Japanese).

The present invention relates to a method of irradiation with electron beams with the aim of increasing the output current. A scanner successively disposed in an accelerating tube comprises two scanning elements with two branch joints provided with an irradiation window. An electron beam accelerated by said accelerating tube is subjected to scanning in the direction vertically crossing the direction between two scanners by means of a scanning coil disposed between said branch joints and the accelerating tube. Thus, scanned electron beams are exchangeably deflected to both said scanning elements by allowing rectangular current to flow through a deflecting coil disposed between said branch joints and the scanning coil. Thus, electron beams are exchangeably captured from each irradiating window to irradiate the same object. While being captured from said irradiating windows, electron beams are scanned in the direction vertically crossing said deflecting direction. Thus, it is not necessary to provide the scanning coils at every scanning element. Furthermore, the present invention allows electron beam current to be equally divided. In other words, if the heat at the window is kept at the same temperature, twice the output current is obtained to double the irradiating efficiency. (JA)

12219 TRANSISTORIZED HIGH VOLTAGE COMPLEMENTARY SWITCH FOR PULSING A NUCLEAR GENERATOR. Van Cleave, R. A. Jr. (to Texaco Inc.). US Patent 3,851,188. 26 Nov 1974. Filed date 22 Aug 1972. 6p.

A transistorized complementary switch for pulsing a nuclear generator is described. There is one series section of PNP transistors and another series section of NPN transistors, each series section being connected in common base configuration. Each section is alternately driven to high and low impedance conditions to provide the required pulse output. The system was designed for high-voltage pulsing of the deflection plates in a neutron generator for pulsed neutron logging. (Official Gazette)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

12220 ASTROPHYSICAL CONCEPTS. Harwit, M. New York; John Wiley and Sons, Inc. (1973). 573p. $16.50.

An attempt is made to present a wide range of astrophysical topics in sufficient depth to give the reader a general quantitative understanding of the subject. Topics considered include: an approach to astrophysics; the cosmic distance scale; dynamics and masses of astronomical bodies; random processes; photons and fast particles; electromagnetic processes in space; quantum processes in astrophysics; stars; cosmic gas and dust; structure of the universe; and life in the universe. (WDM)

Cosmic Radiation

Refer also to abstracts 12524, 12535, 12555, 12562, 12567, 12597, and 13048.

12221 (BUP-62) CLEFT SIGNATURE IN PROTON FLUXES ABOVE 100 keV. Amundsen, R.; Soeraas, F.; Aarsnes, K. (Bergen Univ. (Norway). Dept. of Physics). Apr 1974. 19p. Dep. NTIS (US Sales Only) $4.25.

Experimental evidence is presented that the above 100-keV proton fluxes precipitating at high latitudes on the dayside constitute the high energy tail of the low energy proton population which is the signature of the polar cleft region. The precipitation zone of these higher energy protons covers the same latitude band as do the low energy particles, and also experiences the same latitudinal displacements during changes in the geomagnetic conditions. The precipitation has an isotropic pitch angle distribution, and the measured higher energy intensities compare favorably with values extrapolated from the spectrum at lower energies. The statistical invariant pattern described by these above 100 keV precipitating protons in the magnetic local time span 06 to 18 hours is presented. (auth)

12222 ANALYSIS OF JET SHOWERS WITH AEROPLANE EMULSION CHAMBER. Maeda, Y. (Yokohama National Univ., Japan). Uchusen Kenkyu; No. 2, 183-196(Dec 1973). (In Japanese).

An experiment to observe charged secondary component and neutral secondary component with an emulsion cloud chamber on an airplane was performed. The airplane emulsion chamber (AEC) consisted of an upper chamber and a lower chamber. The upper chamber was composed of thin methacrylic plates and nuclear plates, and the lower chamber was composed of lead plates, nuclear plates, and x-ray films. Jet showers were traced back upwards from cascade showers in lower emulsion chamber. Multiplicity, angular distribution, and the mode of multiple scattering were observed. Energy distribution and angular distribution of the neutral component were also observed. Since charged secondary particles emitted at large angle may be overlooked, modified F-plot method was applied for the analysis of charged secondary particles. The neutral component was analyzed by using an ordinary method. The results of analysis showed that the velocity of fire balls in gravity center system is about 2, inelasticity increases with the increasing mass of fire balls, the ratio of energy of the charged component and the neutral component is about 2, and shows charge independence, and the ratio of number of secondary particles emitted forward and backward from individual fire balls in the gravity center system is nearly one. (JA)

12223 COSMIC RAY INTENSITY ANISOTROPY DURING THE BEGINNING PHASE OF FORBUSH DECREASE OF AUGUST 4, 1972. Chiba, T. (Iwate Univ., Morioka, Japan); Ishida, Y.; Kawasaki, S.; Kodama, M.; Wada, M. Rep. Ionosphere Space Res. Jap.; 27: No. 4, 163-169(1973).

Using the cosmic-ray neutron data from 44 stations, the characteristics of the Forbush decrease which occurred on August 4, 1972 are investigated on an hourly basis in terms of intensity anisotropy during the beginning phase of the event. The decrease on the equatorial plane begins earlier in the garden-hose direction and latest in the anti-Sun direction. It is found that the anisotropy in space persists for over 7 hours, its magnitude reaching a maximum of about 8 percent. (auth)

12224 MOTION OF SURVIVED NUCLEI IN AIR SHOWER AND GENERATION OF SUBSHOWERS. Oda, H. (Kobe Univ., Japan). Uchusen Kenkyu; 18: No. 2, 154-182(Dec 1973). (In Japanese).

Survived nuclei and subshowers in an air shower were investigated. P_t distribution of the survived nuclei is not clear, and $\sqrt{\langle P_t^2 \rangle}$ was taken as a parameter. The magnitude of $\sqrt{\langle P_t^2 \rangle}$ may be taken a little larger than 1 GeV. Distribution of inelasticity K is also uncertain, and $\langle K \rangle$, K^*, and K^+ were used as parameters. The collision mean free path λ of nucleons was assumed to be constant. The atmosphere of uniform temperature of scale height H was considered as a model of atmosphere. Primary particles were protons of energy E_1. The depth of observation level was shown as Z_{obs} and the values of Z_{obs}/λ employed were 5.9, 8.1, and 11.4. An approximate formula $\sin\theta \approx \theta$ was used for calculation. Energy of the survived nuclei and the subshowers, the height of generation of the subshowers, the inclination of axes of the subshowers, horizontal distance of the points of generation of the subshowers from the axis of the shower, distance of the centers of the subshowers from the axis of the shower at depth Z_{obs}, $E_1\sqrt{\langle P_t^2 \rangle}$, and distance between subcores and main core were numerically obtained. The results are graphically displayed. (JA)

12225 MONTE CARLO ANALYSIS OF THE SOLAR-WIND MODULATION OF GALACTIC C-N-O AT SOLAR MAXIMUM. Moss, T.A. (Louisiana State University, Shreveport); Giuli, R.T. Astrophys. J. 192: No. 3, 753-755 (15 Sept 1974).

We have extended our Monte Carlo analysis of the solar-wind modulation of galactic cosmic-ray rigidity spectra to include particles in the C-N-O group. We find that a solar cavity "radius" of 7.a.u. is consistent with observations of the C-N-O component at solar maximum. We also find that the variation in modulation between solar maximum and solar minimum may be explained solely by variation of the solar cavity size, with no change in the scattering mean free path. (auth)

12226 RIGIDITY SPECTRUM OF $Z \geq 3$ COSMIC-RAY NUCLEI IN THE RANGE 4-285 GV AND A SEARCH FOR COSMIC ANTIMATTER. Golden, R.L.; Adams, J.H. Jr.; Deney, C.L.; Badhwar, G.D.; Marar, T.M.K. (NASA Johnson Space Center, Houston, Texas); Heckman, H.H.; Lindstrom, P.J. Astrophys. J. 192: No. 3, 747-751 (15 Sept 1974).

A measurement, using the magnetic emulsion spectrometer system, of the differential rigidity spectrum of $Z \geq 3$ nuclei of the galactic cosmic radiation is presented. The system was flown on 1969 August 22 from Palestine, Texas. The instrument floated above 125,000 feet for 8 hours. The data in the rigidity range 8-285 GV can be represented by a power-law spectrum in rigidity, $J(\rho) = A\rho^{-\gamma}$, with the exponent $\gamma = 2.6 \pm 0.10$. The spectrum in the range 15-285 GV is also described by the same exponent, $\gamma = 2.6 \pm 0.25$. The data below 8 GV cannot be described by the same power law without invoking solar modulation. A set of nonunique parameters for modulation are given. Upper limit for the fraction of antimatter in the rigidity range 4-125 GV is 5×10^{-3} with 95 percent of confidence limit. (auth)

12227 RELATIVE ABUNDANCES OF POSITRONS AND ANTIPROTONS IN THE PRIMARY COSMIC RAY FLUX. Badhwar, G. D.; Golden, R. L. (National Aeronautics and Space Administration, Houston, TX). Nature (London); 251: No. 5471, 126(13 Sep 1974).

Reference is made to Shen and Berkey (Phys. Rev. 171: 1344 (1968)) who calculated the ratio of antiprotons and positrons in primary cosmic rays assuming that both components are the end products of proton-proton interactions, and who stated that observations of the positron spectrum would permit deduction of the antiproton energy spectrum. The present authors used the results of observations on the ratio $e^+/(e^+ + e^-)$ to obtain an upper limit on $\bar{p}/p$ at various energies; they made use of detailed measurements of the cross section for antiproton production up to interesting storage ring energies. The latest $\bar{p}$ and Λ^1 production cross sections are shown graphically. It has been shown that the ratio of the mean energy of antiprotons to incident proton energy is approximately 9, irrespective of incident proton energy, a result differing from the results of Shen and Berkey who found the ratio varies as $E^{1/4}$. Calculations gave the ratio $e^+/\bar{p}$ as 4 at 5 GeV and 1.56 at 10 GeV. These values depend only on the spectral index of the differential proton energy spectrum. (UK)

12228 CORRECTIONS FOR COINCIDENCE AND DEAD-TIME EFFECTS IN THE RECORDING OF STATISTICAL PULSE GROUPS. Debrunner, H.; Flueckiger, E.; Keller, J. (Univ., Bern). Helv. Phys. Acta; 47: No. 4, 463-469(1974). (In German).

In the recording of the secondary nucleon component of cosmic radiation in the atmosphere by the use of neutron monitors the counter pulses occur in statistical pulse groups. Because of the limited open time and the dead time and because of coincidences the measured pulse group distribution is not the accurate distribution. An attempt is made to derive accurate corrections for the coincidence and dead-time effects in neutron monitors. The accuracy of the correction method developed was tested by a Monte

Carlo simulation which showed that the method needs improvement but is at present the best approximation to the true ratios. (JSR)

12229 MONTE CARLO CALCULATION OF THE SECONDARY PROTON AND NEUTRON SPECTRA. Debrunner, H.; Flueckiger, E. (Univ., Bern). Helv. Phys. Acta; 47: No. 4, 457-462(1974). (In German).

A computer program for the simulation of nucleon cascades in the atmosphere was developed with two partial programs. The first partial program follows the primary and secondary nuclear-reactive particles through the atmosphere and determines the positions of the individual nuclear reactions on the basis of the mean free path. Within this program the calculated results for the secondary zenith proton spectra were compared with experimental data. The variation of the calculated and measured value led to the introduction of a correction of the mean free path. The calculated and measured values were then in good agreement. The corrected program was applied to the neutron with good agreement with measurement data. (JSR)

12230 OBSERVATION OF FEATURES IN THE SOFT X-RAY BACKGROUND FLUX. Williamson, F.O.; Sanders, W.T.; Kraushaar, W.L.; McCammon, D.; Borken, R.; Bunner, A.N. (Department of Physics, University of Wisconsin, Madison). Astrophys. J. Lett. 193: No. 3, L133-L137 (1 Nov 1974).

Two rocket observations of the soft X-ray diffuse intensity demonstrate the existence of three enhanced emission regions of large angular extent. One is centered $l^{II}=205°$, $b^{II}=-40°$, one runs along $l^{II}=235°$ from $b^{II}=-30°$ toward the South Galactic Pole, and one is centered near $l^{II}=210°$, $b^{II}=20°$. All three regions are approximately coincident with broad regions of relatively small column densities of neutral hydrogen. It is suggested that a component of the interstellar medium is very hot ($T\simeq10^{6}$°K) and is responsible for both the soft X-ray emission and O VI as seen in the ultraviolet absorption spectrum of early-type stars observed by Copernicus. (auth)

12231 COSMIC RAY ALBEDO NEUTRON SPECTRUM AT RELATIVISTIC ENERGIES. Ershkovich, A.I. (Department of Environmental Sciences, Tel-Aviv University, Ramat-Aviv, Israel). J. Geophys. Res. 79: No. 34, 5295-5296 (1 Dec 1974).

The omnidirectional spectrum of the cosmic ray albedo neutrons at relativistic energies has been estimated from the geometrical considerations. Since angular distribution of the albedo neutron flux escaping the earth's atmosphere depends on the neutron's energy, the omnidirectional spectrum appears to be much steeper than the unidirectional one. It is shown that the albedo neutron spectrum softening discovered by Freden and White from proton spectrum measurements in the inner radiation belt may be due to this effect. (auth)

12232 FISSION TRACKS IN A WHITE INCLUSION OF THE ALLENDE CHONDRITE-EVIDENCE FOR ^{244}Pu. Shirck, J. (Washington Univ., St. Louis, Mo. (USA)). Earth Planet. Sci. Lett.; 23: No. 3, 308-312(Oct 1974).

Fossil fission tracks were found in a coarse-grained white inclusion of the Allende chondrite. Tracks are present in excess of those produced by ^{238}U spontaneous fission and cosmic rays. The ratio of excess tracks to ^{238}U tracks is ~20, intermediate to ratios previously observed in meteorites but much lower than might be expected in light of the high initial ^{244}Pu/U ratio measured in these inclusions from Xe isotope ratios. (auth)

Stars

Refer also to abstracts 12276, 12277, and 12524.

12233 (AD-779370) APERTURE SYNTHESIS OF FORMALDEHYDE ABSORPTION IN SGR A. Whiteoak, J. B.; Rogstad, D. H.; Lockhart, I. A. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0019. 21p. NTIS $3.00.

Synthesis observations of the 4830 MHz formaldehyde absorption originating near SGR A are presented. The synthesized beamwidth is 20 arcsec in right ascension and 40 arcsec in declination. The velocity resolution is 6.2/kms. The results suggest that the broad +40/kms absorption feature arises in two separate dense molecular clouds behind, and moving away from, the center of the galaxy. (auth)

12234 LUMINOSITY FUNCTION OF THE STAR CLUSTER M67. Popova, M. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 67-71(1972). (In Russian).

With the aid of the blue copy of the Palomar atlas 17089 stars of the nucleus and corona of the star cluster M 67 and the galactic background surrounding it were photometered. The method of diameters was used. On the basis of the photometric data the luminosity function of M 67 up to 20.5m with the inclusion of the corona was obtained for the first time. It is demonstrated that the inferences about the absence of faint stars in M 67 are groundless and are due to the fact that the stars of the corona have not been taken into account. Instead of an abrupt drop of the luminosity function after the maximum at 14^{m} and its drop to zero, a second higher maximum is obtained at 18^{m}. The results obtained are of importance in deducing the function of star formation and in determining the age of the cluster. (tr-auth)

12235 THERMAL EQUILIBRIUM IN MOLECULAR HYDROGEN CLOUD. Kudo, A. (Tohoku Univ., Sendai). Sci. Rep. Tohoku Univ., First Ser.; 56: No. 4, 152-169(Dec 1973).

The thermal balance in molecular hydrogen clouds is considered. The ionization rate by low energy cosmic rays and x-rays is calculated, taking the ionization, dissociation and excitation due to the secondary energetic electrons into consideration. Heating rates by these processes are calculated, including the energy due to the molecular reactions and the effect of energetic electrons. The cooling rates of atomic and molecular species which are efficient in dense clouds are estimated, considering the self-absorption of the cooling lines and the attenuation of ionizing ultraviolet radiation of carbon atoms. The equilibrium temperature at the center of cloud and the hydrogen abundance as functions of hydrogen density are computed for several ionization rates. The comparison with observations shows that if low energy cosmic rays are present in dark clouds, the rate of direct ionization of hydrogen atoms by them should be less that 10^{-18} sec^{-1} which is two orders of magnitude less than required in general interstellar space, and that the energy input to dark clouds due to photoionization by diffuse x rays above 0.2 keV is comparable in importance to cosmic ray heating. (auth)

12236 SEARCH FOR CORRELATIONS BETWEEN GIANT RADIO-PULSES AND 10^{11} eV GAMMA RAYS FROM NP0532. Argyle, E. (Dominion Radio Astrophysical Observatory, Penticton, B. C.); Baird, G.; Grindlay, J.; Helmken, H.; O'Mongain, E. Nuovo Cim., 24B: No. 2, 153-156(11 Dec 1974).

Ten hours of simultaneous observations of NP 0532 at radio frequency 146 MHz and gamma-ray energy 10^{11} eV have revealed no coincidence events between 300 giant radio-pulses and gamma-ray-produced air showers. The results are consistent with the pulse stability reported at optical frequencies. (auth)

12237 SPECTROPHOTOMETRIC STUDY OF n CASSIOPEIA. IV. Kovacev, B. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 47-63(1972). (In Russian).

A spectrophotometric study was made of the star n Cassiopeia on the basis of observation material obtained by O. P. Golandskii and I. M. Kopilov with a 1.22 m telescope of the Crimean Astrophysical Observatory. Five of the spectrograms used are with dispersion 23.4 Å/mm in the interval $\chi\chi$ 3600-5000Å. They were obtained in 1958 with the aid of a single-prism spectrograph. The other seven spectrograms were obtained by an ASP-11 diffraction spectrograph with dispersion 14Å/mm. Of them five are in the spectral interval $\chi\chi$ 300-4200Å and two in the interval $\chi\chi$ 4100-4800Å. The results of 1958 were compared with those obtained by O. P. Golandskii and I. M. Kopilov from the same observation material. (tr-auth)

12238 STRUCTURE OF EMISSION NEBULAS. Miller, J. S. Sci. Amer.; 231: No. 4, 34-43(Oct 1974).

An emission nebula is a cloud of interstellar gas that shines by its own light. Each kind of ion in it has a characteristic color, and three-color photography reveals how the ions are distributed. (auth)

12239 ^{22}Ne(α,n)^{25}Mg REACTION IN CONe MANTLE OF MASSIVE STARS AT HIGH TEMPERATURES. Kakati, B. N.; Duorah, H. L. (Gauhati Univ., India). Pramana; 3: No. 2, 89-94 (Aug 1974).

The effectiveness of ^{22}Ne(α,n)^{25}Mg reaction as a neutron source is examined at high temperatures $0.8 \leq T_9 \leq 3.0$ (T_9 is the temperature in units of 10^9 K). An assembly consisting of ^{12}C, ^{16}O, and ^{22}Ne is considered at the end of helium burning in some massive stars. Alpha particles necessary for this neutron producing reaction are assumed to be due to reactions involving ^{12}C and ^{16}O nuclei. Assuming ^{22}Ne as the only neutron absorber, the number density of neutrons is calculated. The mantles outside the cores of massive stars are possibly the physical sites for these reactions. (auth)

12240 BLACK HOLES. Golli, B. (Univ., Ljubljana, Yugoslavia). Obz. Mat. Fiz.; 20: No. 2, 48-54(1973). (In Slovak).

The origin of the black hole and with some possibilities of its detection are considered. Then two observers are discussed, one observing the black hole from a great distance and the other the other freely falling into it. (auth)

12241 ARC MEASUREMENTS OF Fe I OSCILLATOR STRENGTHS. Bridges, J.M.; Kornblith, R.L. (Institute for Basic Standards, National Bureau of Standards, Washington, D. C.). Astrophys. J. 192: No. 3, 793-812 (15 Sept 1974).

Oscillator strengths for 534 lines of Fe I have been measured from a wall-stabilized arc. These lines have wavelengths between 2900 and 5800 Å and cover a wide range in intensity and upper energy level. Lifetime values were used in normalizing to an absolute scale and in determining the arc temperature. This temperature agreed with that found independently, using LTE plasma diagnostics. Comparisons with other recent oscillator strength measurements generally show agreement within combined error estimates. (auth)

12242 DQ HERCULIS: PERIODIC CIRCULAR POLARIZATION SYNCHRONOUS WITH THE RAPID LIGHT VARIATIONS. Swendlund, J.B. (Battelle Observatory, Battle Northwest, Richland, WA 99352); Kemp, J.C.; Wolstencroft, R.D. Astrophys. J. Lett. 193: No. 1, L11-L13 (1 Oct 1974).

Variable circular polarization, synchronized with the rapid light variations, has been discovered in DQ Her. The fundamental period is 142 seconds, twice the light period. The peak-to-peak amplitude of Δq is about 0.2 percent. It is concluded that DQ Her contains an oblique magnetic rotator. (auth)

12243 DQ HERCULIS: PERIODIC LINEAR POLARIZATION SYNCHRONOUS WITH THE RAPID LIGHT VARIATIONS. Kemp, J.C. (Department of Physics, University of Oregon, Eugene, OR 97403); Swedlund, J.B.; Wolstencroft, R.D. Astrophys. J. Lett. 193: No. 1, L15-L19 (1 Oct 1974).

Linear-polarization variations synchronized with the 71^s light variations have been found in DQ Her. As with the circular polarization, the fundamental period is 142^s, twice the light period. The largest amplitude is in the ultraviolet, wherein ΔQ, $\Delta U \simeq 0.6$ percent. A model is presented. (auth)

12244 STARS IN THE MASS RANGE $7 \lesssim M/M_\odot \lesssim 10$ AS CANDIDATES FOR PULSAR PROGENITORS. Barkat, Z.; Reiss, Y.; Rakavy, G. (Department of Theoretical Physics, Hebrew University of Jerusalem). Astrophys. J. Lett. 193: No. 1, L21-L23 (1 Oct 1974).

Both general arguments and preliminary evolutionary calculation suggest that stars in the mass range $7 \lesssim M/M_\odot \lesssim 10$ develop cores of $\sim 1.45\ M_\odot$, which evolve toward high density ($\rho \sim 2 \times 10^{10}$ g cm^{-3}) after burning all their carbon. Even if detonation finally occurs, these cores are not expected to be disrupted. It is suggested that more attention be given to this mass range, which seems promising with regard to pulsar formation. (auth)

12245 HIGH-FREQUENCY OPTICAL VARIABLES. II. LUMINOSITY-VARIABLE WHITE DWARFS AND MAXIMUM ENTROPY SPECTRAL ANALYSIS. Richer, H.B.; Ulrych, T.J. (Department of Geophysics and Astronomy, University of British Columbia, Vancouver, Canada). Astrophys. J. 192: No. 3, 719-730 (15 Sept 1974).

In a search for luminosity-variable white dwarf stars, two new periodic variables were found, EG 65 (G117-B15A) and EG 197 (G169-34). The former has a period of 1311 s while the latter varies on a time scale of 465 s. Using EG 65 as a typical variable of this class of stars, we show that the burning of hydrogen accreted from the interstellar medium can account for the energy needed to keep the star in oscillation. Maximum entropy power spectral analysis, which was used to identify the 1311-s period, is discussed in an appendix. (auth)

12246 THE DEFORMED FIGURES OF THE DEDEKIND ELLIPSOIDS IN THE POST-NEWTONIAN APPROXIMATION TO GENERAL RELATIVITY. Chandrasekhar, S.; Elbert, D.D. (University of Chicago). Astrophys. J. 192: No. 3, 731-746 (15 Sept 1974).

The effects of general relativity, in the post-Newtonian approximation, on the Dedekind figures of equilibrium of homogeneous masses are determined. It is shown how the post-Newtonian figures can be obtained by first altering the velocity field in the Dedekind ellipsoid, appropriately, and then subjecting it to a suitable Lagrangian displacement cubic in the coordinates. The solution exhibits a singularity at a point where the axes of the Dedekind ellipsoid are in the ratios 1:0.6158:0.4412. However, in contrast to what happens along the Jacobian sequence, the occurence of the singularity along the Dedekind sequence is not associated with the onset of any instability at that point by a strict Newtonian-like dynamic perturbation. (auth)

12247 ULTRAVIOLET SPECTROPHOTOMETRY OF SIRIUS FROM GEMINI 12. Spear, G.G.; Kondo, Y.; Henize, K.G. (NASA Lyndon B. Johnson Space Center, Houston, Texas). Astrophys. J. 192: No. 3, 615-621 (15 Sept 1974).

The spectral energy distribution of Sirius between 2500 and 3700 Å at a resolution of 7 Å is obtained from plates taken on Gemini 12. The agreement with other observations and the most recent line-blanketed model atmospheres is good. The equivalent width of the Mg II doublet near 2800 Å is 6.0 Å if the continuum level is represented by regions near 2650 and 2910 Å. This is consistent with expectations for a hot Am star and implies line blocking of up to 15 percent in this wavelength region. (auth)

12248 OBSERVED DEPARTURES FROM LTE IN STELLAR FE I LINES. II ARCTURUS. Smith, M.A. (Department of Astronomy, University of Texas, Austin). Astrophys. J. 192: No. 3, 623-627 (15 Sept 1974).

The application of the Athay and Lites model Fe I atom to stars of lower surface gravities by Lites and Cowley has made possible a comparison of these authors' predicted departures from LTE for Fe I lines in Arcturus using observed central core depths and line strengths taken from the Griffin Atlas. The Athay and Lites atom allows a division to be made of all Fe I transitions into a simple trichotomy of groups. Two of the three groups show identical departures from LTE in Arcturus by an amount which is about half that predicted by Lites and Cowley. The third group, composed of high-excitation lines, shows little evidence for such departures. The observed departures occur for lines of reduced equivalent widths greater than 30. A neglect of these departures could lead to an overestimate of the microturbulent parameter by the negligible factor of 12 percent. Only if lines on the flat portion of the curve of growth were to be used could an error in the abundance of Fe of a factor of 2 be made. Otherwise, non-LTE effects should not influence the determination of metallicity in K giants. These results are in quantitative agreement with our previous investigation of non-LTE in the solar Fe I spectrum. (auth)

12249 CONSTRAINTS ON MODELS FOR CHEMICAL EVOLUTION IN THE SOLAR NEIGHBORHOOD. Tinsley, B.M. (The University of Texas at Dallas and Austin). Astrophys. J. 192: No. 3, 629-641 (15 Sept 1974).

Chemical evolution in the local region of the Galaxy is described by analytical approximations to models based on a variety of hypotheses that have been proposed to account for the observed abundances in stars, interstellar gas, and the solar system. There are many alternative (although not always mutually exclusive), physically plausible models to be considered, and many parameters related to nucleosynthesis, star formation, gas flows, etc., which cannot be reliably determined a priori. In spite of these uncertainties, it is found that very few types of models are consistent with several important empirical constraints. These are the paucity of metal-poor stars, the small difference between the mean metal abundances of the oldest and youngest disk stars, and the lack of observable change in certain isotopic abundance ratios during the last 4.5 billion years. Unless there is an unknown Galactic site of deuterium production, the production rates in supernovae of other light elements relative to deuterium appear to restrict the class of viable models further to those in which a significant fraction of primordial deuterium has not been processed through stars. Either metal-enhanced star formation or the infall of primordial gas leads to evolutionary models consistent with all these constraints. It is found that the ratio between s-process abundances and stellar production factors is nearly model-independent, but that the relative importance of the big bang or red-giant stars as the source of ^{3}He depends on details of the evolutionary history. (auth)

12250 THE NEGATIVE CORRELATION BETWEEN THE CARBON-TO-IRON RATIO AND THE IRON ABUNDANCE. Talbot, R.J. Jr. (Department of Space Physics, and Astronomy, Rice University). Astrophys. J. 192: No. 3, 643-646 (15 Sept 1974).

The observed negative correlation between [C/Fe] and [Fe/H] is a natural consequence of galactic evolution with a constant initial mass function of star formation. The decrease of C is larger than for other elements owing to the relatively large efficiency of the secondary production of N. (auth)

12251 CNO ABUNDANCES AND HYDRODYNAMIC MODELS OF THE NOVA OUTBURST. III. 0.5 $M_\odot$ MODELS WITH ENHANCED CARBON, OXYGEN, AND NITROGEN. Starrfield, S. (IBM T. J. Watson Research Center, Yorktown Heights, New York;); Sparks, W.M.; Truran, J.W. Astrophys. J. 192: No. 3, 647-655 (15 Sept 1974).

We have continued our study of the nova outburst by considering the evolution of thermonuclear runaways in the hydrogen-rich envelopes of 0.5 $M_\odot$ carbon-oxygen white dwarfs. The larger radii of these stars, compared with the 1.00 $M_\odot$ white dwarfs (Paper II), results in a lesser degree of degeneracy at the same depth in the star. In order to obtain hydrogen-rich material at depths with large degrees of degeneracy, envelope masses of 10^{31} grams are required (4 times the mass of the 1.00 $M_\odot$ envelopes). We present four models of luminosity $3.55 \times 10^{-3}\ L_\odot$, differing only in the initial abundances of ^{12}C, ^{14}N, and ^{16}O. The degree of enhancement required to produce mass ejection, and thereby a nova-type outburst, is greater than for the 1.00 $M_\odot$ model. Nevertheless, the evolution of the 0.5$M_\odot$ model that ejected material is very similar to that of the 1.00 $M_\odot$ model, and it also ejects significant amounts of ^{13}C, ^{15}N, and ^{17}O into the interstellar medium. The 0.5 $M_\odot$ outburst is considerably less intense than the 1.00 $M_\odot$ outburst (even under optimum conditions), and we might interpret this lower mass behavior as associated with the observed outburst of the

slowest novae. The evolutionary characteristics of the 0.5 $M_\odot$ white dwarf allow us to put forth the same explanations for Kukarkin and Parenago's relationship and continuous ejection that we did for the models at 1.00 $M_\odot$. (auth)

12252 LIGHT-DECAY CURVE OF THE SUPERNOVA IN IC 4182. Van Hise, J.R. (Pacific Union College, Angwin, California). Astrophys. J. 192: No. 3, 657-659 (15 Sept 1974).

The well-known light decay curve of the supernova in IC 4182 is analyzed for half-life components. The well-known long-lived component is found to be 56 days. The short-lived component decays exponentially with a half-life of 4.8 days. The possibility of associating the two components with the decay of ^{56}Ni and ^{56}Co is discussed. (auth)

12253 MECHANISMS OF STAR FORMATION. Reddish, V. C. (Royal Observatory, Edinburgh). Phys. Bull. (London); 24: 661-664(Nov 1973).

There is abundant evidence showing that stars form out of interstellar gas, and that this is a continuing process in some galaxies but has been completed in others. However there is as yet no generally accepted theory of the mechanism of star formation. Some of the alternative theories are here summarized. If stars are formed through supersonic turbulence or shocks, there should be a good spatial correlation between them and young stars such as O stars, T Tauri stars, some infrared stars and OH emission sources. Systematic detailed measurements of interstellar gas velocities in the regions of such objects are needed. If fragmentation of clouds results from molecule formation, large clouds of molecules should really be agglomerations of small dense subclouds of stellar mass, and analysis of measurements of microwave radiations by the molecules, of 21 cm radiation by the residual H I, and of the optical depths due to dust, should show whether or not this is so. Furthermore, the evolution of model galaxies of stars formed from clouds of molecules has led to predictions of much higher abundances of grains and heavy elements in the small amounts of residual gas in elliptical galaxies than in the larger amounts in spirals. (UK)

12254 NEUTRON STARS. Roxburgh, T. W. (Queen Mary Coll., London). Phys. Bull. (London); 24: 664-667(Nov 1973).

As the period of pulsars was found to be gradually decreasing it was considered that the "clock" of the pulsars was a tiny spinning neutron star whose rotational energy is in some way the source of the electromagnetic energy. The mass-radius relation for simple models and the mass-central density relation for detailed lowest energy models of white dwarfs and neutron stars are considered. It is shown that the present models of neutron stars consist of a solid core, superfluid core, a fluid mantle, and a solid crust and the composition varies from hyperons at the center to neutrons to neutron rich nuclei to ^{56}Fe. The problems relating to the theories of the origin of neutron stars are discussed. The most plausible hypothesis still remains that they were produced in supernovae. Although theoreticians have so far been unable to show how they are produced it could be that a detailed analysis of contraction and collapse will reveal a mechanism whereby these stars can be formed—but perhaps strong gravitational fields have consequences not yet discovered. (UK)

12255 INFRARED STARS OR INFRAREDDENED STARS. Allen, D. A.; Penston, M. V. (Royal Greenwich Observatory, Hailsham, Eng.). Nature (London); 215: No. 5471, 110-112(13 Sep 1974).

It is stated that extreme interstellar reddening, accompanying visual absorption of order 100 magnitudes, is still a viable explanation for infrared objects like Becklin's star, in spite of recent claims to the contrary. It is unnecessary at this stage to invoke a new phase of protostellar evolution to account for them. (auth)

12256 KINEMATICAL PARAMETERS FOR MAIN SEQUENCE AND GIANT TYPE III STARS. Gomez, A. E. Astron. Nachr.; 295: No. 3, 133-139(1974).

The parameters of solar motion and velocity ellipsoid are derived from radial velocities of spectroscopically well defined samples of the main sequence and of the giant type III stars. A short discussion of the statistical method applied is given. The results found indicate that the parameters of the velocity ellipsoid chosen arbitrarily for a group of stars does not always represent correctly the sample observed. (auth) (IAA)

12257 NONSELF-SIMILAR MOTIONS OF BLAST WAVES IN STELLAR MODELS. Mallik, D. D.; Singkh, P.; Debrei, G. Vestn. Leningrad. Univ., Mat., Mekh., Astron.; No. 7, 125-132(Apr 1974). (In Russian).

The main aim of this paper is to study nonself-similar motion of varying shock strength due to instantaneous central explosion. Undisturbed density of the medium obeys power law $\rho \sim r^{-\omega}$, where ω is a positive index. For $\omega = 2.5$ the problem reduces to self-similar motion. The problem was handled in a general way and numerical calculations were performed for the only case $\omega = 2{,}49$ and $\gamma = 5/3$ as a series solution, and the behavior of the curves for pressure, density, and velocity was compared up to second approximation with those of self-similar motion. (auth)

12258 PHOTOELECTRIC OBSERVATIONS OF NOVA VULPECULAE 1968(1) = LV VUL. Dworak, T. Z.; Winiarski, M. (Uniwersytet Jagiellonski, Krakow (Poland). Obserwatorium Astronomiczne). Acta Astron.; 22: 33-40(1972).

The brightness of the star Nova Vul 1968 (1) = LV Vul was observed photoelectrically, in two colors, by means of a 20 cm refractor, from April 27 to September 4, 1968. There were 128 measurements made in yellow and 126 in blue color. The results were reduced to the BV system and compared with observations obtained by others. The exact position of Nova Vul 1968 (1) was also determined. (auth)

12259 SPECTRAL AND PHOTOELECTRIC OBSERVATIONS OF BW VULPECULAE. Kubiak, M. (Warsaw Univ. (Poland). Obserwatorium Astronomiczne). Acta Astron.; 22: 11-32(1972).

Photoelectric observations of BW Vul in Stromgren uvby system reveal the existence of stillstand in color, corresponding to the stillstands in brightness and radial velocities. The effective temperature varies by about 5000°K during the cycle. Measurements of 48 coudé spectrograms with the dispersion 9 A/mm, covering the whole cycle, reveal the pronounced changes of equivalent widths of the absorption lines. Observed light curve can be approximated by the superposition of the changes of brightness resulting from the changes of effective temperature and radius. (auth)

12260 LINEAR SERIES AND OF STELLAR MODELS. Pt. 1. Thermal Stability of Stars. Paczynski, B. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 163-174 (1972).

Similarity between a sequence of static stellar models and the linear series of Poincaré is emphasized. The points where the stellar mass (or the core mass) passes through an extremum correspond to the turning points of the linear series. Turning points separate the branches of a linear series occupied by thermally stable and thermally unstable stellar models. A model at the turning point is in a neutral equilibrium and its Schwarzschild (and Henyey) determinant vanishes. That determinant changes sign at the turning point. Stable models must have the determinant of the same sign as the stable main sequence stars. Models with the opposite sign of determinant must be unstable. Some examples are given for the turning points, bifurcation points, and terminating points. The relation between the Schwarzschild and Henyey determinants is discussed. These determinants are proportional to each other. It is shown that the time step used in the evolutionary computations performed by means of the Henyey method must be longer than the time scale of heat diffusion across any mass zone that is in the radiative equilibrium. The time step must be sufficiently small at the same time, so as to keep the sign of the Henyey determinant constant during the evolution. (auth)

12261 ERUPTIVE BINARIES. Pt. 5. Period Variations. Smak, J. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 1-9(1972).

The observed rates of period variations are typically between $d \ln P/dt = \pm 10^{-10}$ and $\pm 10^{-8}$ d^{-1}. In the three best studied cases of U Gem, RW Tri, and UX UMa the variations are of alternating character. It is shown that such variations can be due to the exchange between the orbital momentum and the rotational momentum of the disk. To account for the observed variations the masses of the disks must be larger than 10^{27}g and most likely larger than 10^{28}g. (auth)

12262 PROPAGATION OF EXPLOSION WAVES IN STELLAR INTERIORS. Verma, B. G. (Univ. of Gorakhpur, India). Acta Phys. Acad. Sci. Hung.; 36: No. 3, 225-233(30 Sep 1974).

An analytic solution is found to the problem of propagation of explosion waves in stellar models. The strength of the shock surface heading the disturbance as well as the total energy of the wave are taken to vary with time. (auth)

12263 POSSIBLE EXISTENCE OF THE LASER EFFECT IN STELLAR ATMOSPHERES. Lavrinovich, N. N.; Letokhov, V. S. (Inst. of Spectroscopy, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1609-1620(Nov 1974). (In Russian).

The possible existence of inverse populations in the atmospheres of hot (Be) stars is considered for the case of oxygen OI. The

condition for self-excitation of a medium with inverse population as a result of resonant scattering at the amplifying transition is found. The width of the generation line due to the contribution of spontaneous radiation is found for such lasers which belong to the class with nonresonance feedback. It is shown that the width of the generation line may be considerably smaller than that of the amplification line. Methods for experimental observation of the laser effect in stellar atmospheres are considered. (auth)

12264 SIMPLE MODEL OF A STELLAR ATMOSPHERE. Heck, A. (Univ., Liege). Orion; 32: 95-98(1974). (In French).

A simplified model in which spectroscopic absorption lines due to various elements in the stellar atmosphere are not taken into account can be used as a basis for the development of a more realistic model which considers spectroscopic lines. The equation for the hydrostatic equilibrium is discussed along with a transfer equation, distributions of temperature and electronic pressure, model integration processes, and calculations regarding the continuous spectrum. (IAA)

12265 BLUE OBJECTS NEAR M31. II. Frequency Distribution and Statistics. Richter, G. A. (Deutsche Akademie der Wissenschaften, Sonnenberg, Ger.). Astron. Nachr.; 295: No. 1, 27-31(1974). (In German).

The frequency distribution of blue objects as a function of the B-magnitude is considered, giving attention to the separation of white dwarfs and quasi-stellar objects. A (U-B)-(B-I)-diagram of quasi-stellar objects and white dwarfs is presented. A number of the blue objects of a diffuse appearance are presumably compact galaxies. It is pointed out that only a small percentage of the blue objects could be identified with discrete radio sources. (IAA)

12266 THEORY OF EXTENDED STELLAR ATMOSPHERES. I. COMPUTATIONAL METHOD AND FIRST RESULTS FOR STATIC SPHERICAL MODELS. Mihalas, D. (High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado); Hummer, D.G. Astrophys. J. Suppl. Ser. 28: No. 265, 343-372 (Oct 1974).

A method is presented that makes possible, for the first time, the calculation of extended spherical non-LTE model stellar atmospheres in hydrostatic and radiative equilibrium. This method is a generalization of the complete-linearization technique of Auer and Mihalas. Models have been obtained for a star with $M = 60M_\odot$, $L = 1.25 \times 10^6 L_\odot$, and $R = 24 R_\odot$, whose atmosphere is characterized by an effective temperature T_{eff}=39,500°K and a surface gravity log g=3.45, i.e., with a spectral type near O6. These models are differentiated by the magnitude and radial dependence of a radiation force multiplier γ that is inserted into the equation of hydrostatic equilibrium to simulate the effect of radiation force on opacity sources which have not been included explicitly in the calculation. Models have been obtained very close to the limit at which the radiation force and gravity balance; as this condition is approached, the atmospheres become more and more extended. Only hydrogen and helium (Y=0.1) have been included, and six hydrogen lines have been treated explicitly. Although these models show only modest extension, they predict Lα in emission, the lower Balmer lines in absorption, the Balmer jump in absorption, and an infrared excess and ultraviolet deficiency relative to the visual. Continuous energy distributions and the profiles and equivalent widths of Lα, Hα, Hβ, and Hγ are tabulated. The models predict an intrinsic reddening of the colors of extended envelopes relative to plane-parallel atmospheres. A procedure for the extraction of the intrinsic colors of luminous stars from heavily reddened observations is described. (auth)

12267 EVIDENCE FOR A CORONA OF BETA GEMINORUM. Gerola, H.; Linsky, J.L. ; Shine, R. (Joint Institute for Laboratory Astrophysics, University of Colorado); McClintock, W.; Henry, R.C. ; Moos, H.W. Astrophys. J. Lett. 193: No. 3, L107-L110 (1 Nov 1974).

Using the Princeton spectrometer on the satellite Copernicus, a strong emission line has been detected in the K0 giant β Gem at 1218.4 Å, which is identified as the $^1S_0-{}^3P^0_1$ intercombination line of O v. The strength of the line is such that it is probably formed in a corona at temperatures near 260000°K rather than in an analog of the solar chromosphere-corona transition region. (auth)

12268 A SPECTROSCOPIC SEARCH FOR COOL WHITE DWARFS. Hintzen, P.; Strittmatter, P.A. (Steward Observatory, University of Arizona). Astrophys. J. Lett. 193: No. 3, L111-L114 (1 Nov 1974).

Ninety faint, high-power-motion stars of color class 0 and +1 from the Lowell Proper Motion Survey have been observed spectroscopically. We report here the discovery of 53 new white dwarfs, at least 20 of which are redder than B-V=0.4. The sample should thus double the number of known cool white dwarfs and suggests that the deficiency of such stars is less severe than previously thought. (auth)

12269 TEMPERATURE AND DENSITY DISTRIBUTION IN THE RADIATIVE LAYER OF WHITE DWARFS. Seidova, P.I.; Éminzade, T.A. (Shemakha Astrophysical Observatory, Academy of Sciences of the Azerbaidzhan SSR). Sov. Astron.-AJ 18: No. 3, 316-319 (Nov 1974).

The temperature distribution is calculated in the radiative envelope of white dwarfs with amass of 1, 0.8, or 0.6 $M_\odot$ and a luminosity of 1, 10^{-1}, 10^{-2}, or 10^{-3} $L_\odot$. Cox and Stewart's computed absorption coefficients are used. The temperature and density are practically independent of mass but do depend on luminosity. Degeneracy should be taken into account even before the ideal-gas pressure equals the degenerate-gas pressure. The luminosity and internal temperature are related by $L_\odot T^{2.8}$. (auth)

12270 NEUTRON STARS AND COMETS. Shklovskii, I.S. (Institute for Space Research, Academy of Sciences of the USSR). Sov. Astron.-AJ 18: No. 3, 390-391 (Nov 1974).

Bursts of hard x rays (soft γ rays) could be generated when cometary material is accreted by neutron stars or white dwarfs. (auth)

12271 SPECTROPHOTOMETRIC OBSERVATIONS OF NGC 6543. Boeshaar, G.O.; Czyzak, S.J. (Perkins Observatory, Ohio State and Ohio Wesleyan Universities, Delaware, Ohio); Aller, L.H. Astrophys. J. Suppl. Ser. 28: No. 264, 335-342 (Oct 1974).

Spectrophotometric observations at the coudé focus of the 200-inch (5-m) Hale telescope were made to investigate the point-to-point intensity changes in the planetary nebula NGC 6543. The observations covered the blue and visible regions of the line spectra; some aspects of the visible regions have been examined by Boeshaar. The observed Balmer decrement seems to fit well with the prediction of Brocklehurst's theory. No indication of a large amount of interstellar extinction has been observed and for an electron temperature of 9000°K the extinction might very well be negligible. Significant density fluctuations (and presumably temperature fluctuations) are indicated. Mean intensities averaged over the nebula cannot be employed to construct a model for this planetary nebula and similarly cannot be used to deduce the chemical composition. (auth)

12272 CALCULATION OF THE EQUILIBRIUM STRUCTURE AND OSCILLATIONS OF POLYTROPIC STARS PERVADED BY TOROIDAL MAGNETIC FIELDS. Miketinac, M. J. (Cape Town Univ. (South Africa)). Comput. Phys. Commun.; 7: No. 7, 410-418(Jul 1974).

This program solves the structure equations determining the equilibrium configurations of a self-gravitating, axisymmetric, perfectly conducting polytrope with the polytropic index n ($\geq$1) in the presence of a toroidal magnetic field. Parameters such as mass, volume, radius etc., characterizing an equilibrium configuration are calculated. In addition, frequencies of the characteristic modes of oscillation are determined using Chandrasekhar's virial tensor method and assuming that the ratio of the specific heats, γ, is equal to 5/3. The structure problem is mathematically a boundary-value problem for a second-order, nonlinear, two-dimensional partial differential equation. This problem is solved numerically by following Stoeckly's method improved by Miketinac and Barton, who used it to calculate post-newtonian corrections to the equilibrium configurations of rotating polytropes. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstract 12265.

12273 X-RAY OBSERVATIONS OF VARIABLE SOURCES. Sanford, P. W. (Mullard Space Science Lab., Dorking, Eng.). Proc. Roy. Soc. (London), Ser. A; 340: No. 1623, 411-422(8 Oct 1974).

The M. S. S. L. x-ray instrument on the Copernicus satellite is described and the constraints governing observations discussed. Reviews of the results of observations made on Cygnus X-3, Hercules X-1, and Cygnus X-1 are given. (auth)

12274 BLACK HOLES. 23rd Session of the Summer School of Les Houches, Grenoble, France, August 1-31, 1972. DeWitt, C.; DeWitt, B. S. (eds.). Universite Scientifique et Medicale et Institut National Polytechnique de Grenoble Ecole d'ete de Physique Theorique Les Houches. New York; Gordon and Breach, Science Publishers, Inc. (1973). 563p. (CONF-720864-). $39.00.

From 23rd session of the summer school of Les Houches; Grenoble, France (1 Aug 1972).

Topics covered in these lectures include: the event horizon; black hole equilibrium states; timelike and null geodesics in the Kerr metric; rapidly rotating stars, disks, and black holes; observations of galactic x-ray sources; black hole astrophysics; and the energetics of black holes. (WDM)

12275 TABULATION OF PULSAR OBSERVATIONS. Terzian, Y. (Cornell Univ., Ithaca, NY). Earth Extraterr. Sci.; 2: No. 2, 63-68(Aug 1972).

Observational parameters of the 65 known pulsars are presented in a tabular and graphical form. (auth)

12276 THE X-RAY BINARY HD 77581. Hutchings, J.B. (Dominion Astrophysical Observatory). Astrophys. J. 192: No. 3, 685-689 (15 Sept 1974).

Measurements are presented from medium- and high-dispersion spectrograms of HD 77581(=2U 0900-40). The spectrum indicates that the primary is losing mass by a stellar wind, at some 10^{-6} $M_\odot$ per year, normal for a BO Ia+ star. Orbital elements are derived for the system which indicate a small eccentricity. A weak emission line is attributable to He II λ4686 and indicates a radial-velocity variation approximately in antiphase with the primary. These results, together with an analysis of the photometric observations, suggest masses of 45 $M_\odot$ and 2.6 $M_\odot$ for the components of the system. (auth)

12277 ANALYSIS OF THE BLUE SPECTRUM OF THE X-RAY BINARY HD 153919. Hutchings, J.B. (Dominion Astrophysical Observatory). Astrophys. J. 192: No. 3, 677-683 (15 Sept 1974).

Radial velocities and line profile measurements are presented, derived from high dispersion spectrograms of the O of star HD 153919 (= 2U 1700-37). A period of 3.4126 days is derived. The velocity amplitudes and V_0 values from different lines are related to their excitation and indicate extreme mass-loss. No direct spectroscopic evidence is found of the secondary, whose mass probably does not exceed 2 $M_\odot$. A model of the system is discussed in which a collapsed star is moving through the extended, rotating envelope of the primary. (auth)

12278 OPTICAL AND X-RAY OBSERVATIONS OF 3U 0614+09. Davidsen, A.; Malina, R.; Smith, H.; Spinrad, H. (Astronomy Department and Space Sciences Laboratory, University of California, Berkeley); Margon, B.; Mason, K.; Hawkins, F.; Sanford, P. Astrophys. J. Lett. 193: No. 1, L25-L29 (1 Oct 1974).

On the basis of positional agreement, ultraviolet excess, and spectroscopic peculiarity, we establish the identification of the X-ray source 3U 0614+09 with a faint ($B \simeq 18.8$) blue star, previously suggested as a candidate by Murdin et al. Four days of 1-3 Å X-ray observations show no evidence for eclipses of signifcant variability. We discuss the evidence that this object may be very similiar to Sco X-1, but at a distance of 4-8 kpc. (auth)

12279 CHANCE COINCIDENCES IN THE ABSORPTION-LINE SPECTRUM OF 4C 05.34. Varshni, Y.P. (Department of Physics, University of Ottawa, Ottawa, Canada). Astrophys. J. Lett. 193: No. 1, L5-L6 (1 Oct 1974).

It is shown that the distribution of absorption-line redshifts for the quasar 4C 05.34 is consistent with the hypothesis that the proposed systems arise because of chance coincidences between the wavelengths of search lines (at appropriate values of z) and the wavelength of observed absorption lines. (auth)

12280 THE X-RAY SPECTRA OF THE VELA AND PUPPIS SUPERNOVA REMNANTS AND THE SHOCK-WAVE MODEL OF SUPERNOVA REMNANTS. Gorenstein, P. (Center for Astrophysics, Harvard College Observatory—Smithsonian Astrophysical Observatory, Cambridge, MA 02138); Harnden, F.R. Jr.; Tucker, W.H. Astrophys. J. 192: No. 3, 661-676 (15 Sept 1974).

The structure and spectrum of the Vela and Puppis (supernova remnants (SNRs) were observed in soft (0.1-1.5 keV) X-rays from a rocket. The spectral data of both objects below 1.5 keV are consistent with thermal radiation from a hot plasma and not consistent with simple power-law function. Fitting the data to a Tucker-Koren (T-K) model results in values of $T = (4.3 \pm 0.3) \times 10^6$ °K for Vela and $T = (7 \pm 1) \times 10^6$ °K for Puppis. Furthermore, extrapolation of the best-fitting T-K models to the 2-6 keV band results in agreement with Uhuru observations. The present data, earlier data from the Cygnus Loop, and results on Cas A and Tycho reported by others are considered within the context of a simple model in which X-rays are thermally produced as a result of a shock wave expanding into the interstellar medium. X-ray data on the temperature, intrinsic diameter, and intrinsic luminosity of the five SNRs are used to compute the age, energy release, and initial interstellar density for each one. There is good agreement with independent measurements of these parameters. From measurements of X-ray absorption along the line of sight, and also from shock-wave model interpretations of temperature-diameter-luminosity relations, we conclude that the average density of intersteller material is about 0.1 cm^{-3} between the Sun and the nearest X-ray emitting SNR, Vela. This is smaller than the average densities we determine for more distant regions of the Galaxy such as the Puppis SNR and the Cygnus Loop. X-ray fluxes for other SNRs are predicted from the shock-wave model. (auth)

12281 OBSERVATIONS OF THE 4.8-HOUR VARIATIONS OF CYGNUS X-3 ABOVE 7 keV FROM THE OSO-7. Ulmer, M.P.; Baity, W.A.; Wheaton, W.A. (University of California, San Diego); Peterson, L.E. Astrophys. J. 192: No. 3, 691-695 (15 Sept 1974).

We report the results of 1972 June 30-July 5 observations made of Cyg X-3 with the UCSD OSO-7 X-ray telescope in the ~7-100 keV range. We detected the 4.8-hour variation in the 6.6-21.2 keV range, and the ratio of high intensity to mean intensity (0.11 ± 0.006 photons cm^{-2} s^{-1} keV^{-1}) was 1.52 ± 0.16. In the 21.2-97.8 keV range we could not detect a 4.8-hour variation in phase with the 6.6-21.2 keV variation, and the ratio at the phase of high intensity to the mean intensity (0.033 ± 0.006 photons $cm^{-2}s^{-1}$ keV^{-1}) was 0.6 ± 0.4. The spectrum derived from averaging over the 4.8-hour variation could be represented by either $1.0/E^{2.07 \pm 0.13}$ photons cm^{-2} s^{-1} keV^{-1} or by $g(E)[0.34/E \exp(E/25.3 \pm 9.7 \text{ keV})]$ photons cm^{-2} s^{-1} keV^{-1}, with the Gaunt factor g(E) approximated as $E^{-0.4}$. (auth)

12282 A MODEL FOR THE RADIO BURSTS OF CYGNUS X-3. Marsh, K.A.; Purton, C.R.; Feldman, P.A. (CRESS/Department of Physics, York University, Toronto). Astrophys. J. 192: No. 3, 697-701 (15 Sept 1974).

Analysis of the available data shows that exponential decay is a characteristic of Cygnus X-3 radio outbursts, suggesting a bremsstrahlung-loss model for the synchrotron-emitting electrons. Observationally, these outbursts exhibit two types of behavior. In one case the expansion of a cloud of ionized gas around a confined synchrotron source can satisfactorily explain the main characteristics of the burst. In the other, the increase of the burst is best attributed to the direct effects of the particle injection. (auth)

12283 ON THE AXISYMMETRIC PULSAR ATMOSPHERE. Hinata, S.; Jackson, E.A. (Department of Physics and Coordinated Science Laboratory, University of Illinois at Urbana-Champaign). Astrophys. J. 192: No. 3, 703-711 (15 Sept 1974).

It is commonly assumed that a magnetized neutron star, with aligned magnetic and rotational axes, necessarily has a poloidal current extending to infinity. In this study, an attempt is made to better understand the physical necessity of such a current, and to estimate the polar region over which it is likely to extend. To this end we examine the relativistic hydrodynamic equations under the assumption that the plasma drift velocity has only a toroidal component which, however, may represent differential rotation. We show that, subject to reasonable boundary conditions for the field on the stellar surface, the integrals of these equations must have a singularity within the light cylinder if the electron region extends from the stellar surface to the light cylinder—demonstrating that a purely toroidal drift velocity is not possible for a cold atmosphere. To estimate the extent of the stellar surface which might have a poloidal current, we obtain an approximate solution of the magnetic field as predicted by a corotational atmosphere near the stellar surface. It is shown that such an approximation predicts the existence of detached as well as closed magnetic surfaces. The separation between these surfaces occurs within a distance $R_c \simeq (R_l/R)^{2/5}R$, which is well within the light cylinder, R_l. The presence of detached line of force, which are inappropriate for an isolated stellar atmosphere, invalidates the approximation of corotation beyond the critical magnetic surface which extends to the radius R_c. We expect the poloidal currents outside the critical magnetic surface. The angular extent of the polar region is then estimated as $\sin \theta_p \simeq (\Omega R/c)^{1/5}$. (auth)

12284 ROTATING MAGNETOSPHERE: ACCELERATION OF PLASMA FROM THE SURFACE. Michel, F.C. (Department of Space Physics and Astronomy, Rice University). Astrophys. J. 192: No. 3, 713-718 (15 Sept 1974).

We solve for the space-charge field about a rotating object having a monopole magnetic field and a zero work-function surface. We generalize this result to obtain an approximate solution for the case of an axisymmetric dipole field, and find that electrons are accelerated from pulsar-like objects to an energy of the order of $\epsilon \sim (8e\omega^2 a^3 B_p/c)^{1/2} \sim 7 \times 10^9$ eV, where ω is the rotation rate (estimated 6 rads s^{-1}), B_p is the polar surface field (estimated 10^{12} gauss), and a is the radius (estimated 10^4 m), with most of the acceleration taking place within a distance $h \sim (a^3\omega/c)^{1/2} \sim 140$ meters. The overall electromagnetic field structure is essentially unchanged from what one predicts by ignoring particle inertia. In the present work, the effect of a mass difference between the negative and positive particles is ignored. The above injection energy differs from that expected for a neutral stellar wind, and we account for this difference on the basis of the charge-separated nature of the plasma here. Incoherent radiation reaction is examined, and is found to play no important role. (auth)

12285 POLARIZATION OF RADIO SOURCES. V. ABSORPTION EFFECTS ON CIRCULAR REPOLARIZATION IN COMPACT SOURCES. Pacholczyk, A.G.; Swihart, T.L. (Steward Observatory, University of Arizona, Tucson). Astrophys. J. 192: No. 3, 591-595 (15 Sept 1974).

There are known difficulties in attributing the observed circular polarization of compact radio sources to synchrotron emission. Circular repolarization (Pacholczyk) is a plausible alternative: it is consistent with the observed frequency dependence of polarization, with the magnetic

field values resulting from synchrotron self-absorption theory, and avoids the known polarization sign-reversal difficulties in the neighborhood of the turnover. Application of the circular repolarization theory leads to the conclusion that the ratio of relativistic to thermal electron density in compact radio sources is between one and 100. (auth)

12286 PULSED 10 TO 30 MeV GAMMA RAYS FROM PSR0833-45. Albats, P. (Case Western Reserve Univ., Cleveland); Frye, G. M. Jr.; Thomson, G. B.; Hopper, V. D.; Mace, O. B.; Thomas, J. A.; Staib, J. A. Nature (London); 251: No. 5474, 400-402(4 Oct 1974).

The detection of pulsed γ-ray emission from the Vela pulsar PSR0833-45 at 10 to 30 MeV is reported. A sharp peak was observed, coincident with the radio pulse, and there was also some evidence for precursor emission. The observations were made in November 1972 using a ballon-borne spark chamber detection system flown from Longreach, Queensland, Australia. At 5000 MHz the pulse became double peaked, with a separation of ~1.8ms between the peaks, whilst at 8415 MHz the later peak dominated and the earlier peak disappeared into a small plateau region in the early part of the pulse. It was found that the 10 to 30 MeV pulse structure from Vela showed similarity to that of the Crab pulsar. (UK)

12287 NEAR ABSENCE OF HARD X-RAY PULSATIONS IN HER X-1. Iyengar, V. S.; Manchanda, R. K.; Durgaprasad, N.; Gohkale, G. S.; Kunte, P. K.; Sreekantan, B. V. (Tata Inst. of Fundamental Research, Bombay). Nature (London); 251: No. 5473, 292-294(27 Sep 1974).

It is stated that new observations of this source made with a large area telescope, carried by a balloon flight from Hyderabad in December 1973, have given an upper limit of 10% for the pulsating component in the energy range 20 to 45 keV, compared with about 40% obtained from earlier observations. This is stated to have important consequences for models proposed for the x-ray emission features of Her X-1. Details are given of the experimental procedure, and results are discussed. No evidence was found for a pulsating component at energies greater than 20 keV. The observations point to a need for a second x-ray component apart from the pulsating part. (UK)

12288 HIGHLY POLARISED RADIO OUTBURST FROM CYGNUS X-3. Seaquist, E. R. (Univ. of Toronto); Gregory, P. C.; Perley, R. A.; Becker, R. H.; Carlson, J. B.; Kundu, M. R.; Bignell, R. C.; Dickel, J. R. Nature (London); 251: No. 5474, 394-396(4 Oct 1974).

It is stated that a high degree of polarisation has been discovered in observations of a recent radio outburst from Cyg X-3. The degree of polarisation increased over a period of 17 days and reached a maximum of 14%. The observations also indicated a high degree of order in the magnetic field and that a thermal plasma co-exists with the radiating relativistic electrons. In addition a new upper limit of 0.05" was obtained for the angular size, together with an improved position for the source. The observations were made in May 1974 using the NRAO four-element phase-stable interferometer at Green Bank. The measurements included flux density and linear and circular polarisation at 2695 and 8085 MHz. An upper limit of 0.5% was obtained for circular polarisation. This limit, together with the theory of synchrotron radiation, placed on upper limit of about 0.02 gauss for the magnetic field in the radiating region. The linear size was deduced as $\leq 8 \times 10^{15}$ cm. The degree of polarisation was lower at 2695 than at 8085 MHz, possibly due to the radiation at 2695 being partially depolarised by Faraday dispersion produced by an ionised thermal plasma associated with the source. Comparisons are made with results obtained in 1972. (UK)

12289 DISTANCES TO THE SOURCES OF OBSERVED GAMMA-RAY BURSTS. Strong, I. B.; Klebesadel, R. W. (Los Alamos Scientific Lab., NM). Nature (London); 251: No. 5474, 396-397(4 Oct 1974).

It is suggested that the brief intense outbursts of soft γ rays of cosmic origin, referred to as "γ-ray bursts", are mainly, though not necessarily entirely, of galactic origin. The bursts so far reported appear to have originated in the local spiral arm of the Galaxy, at distances of several hundred parsec, but data are sparse. An accurate knowledge of the directions of the bursts is stated to be of critical importance to estimates of source distances; at present directional information is available for 11 events, and five of these show alternative positions, with approximately the same galactic latitudes, but quite different galactic longitudes. The similarity of the latitudes is due to the fortuitous orientation of the orbital plane of the satellites used in the observations. With regard to longitudinal distribution six of the determined directions were found to lie on the side of the spiral arm away from the Galactic center. If the sources are associated with the young Population I stars of the spiral arms they would be expected to lie in the longitudinal range ~70° to ~250°. An argument independent of direction for a galactic origin is also discussed. It is warned, however, that it should not be automatically assumed that all the observed "γ-ray bursts" have similar origins, there may well be more than one process for their origin. (UK)

12290 GAMMA RADIATION FROM THE CRAB NEBULA ABOVE 35 MEV. Kniffen, D. A. (Goddard Space Flight Center, Greenbelt, MD); Hartman, R. C.; Thompson, D. J.; Bignami, G. F.; Fichtel, C. E.; Tuemer, T.; Oegelman, H. Nature (London); 251: No. 5474, 397-399(4 Oct 1974).

Observations of the Crab above 35 MeV are reported, made with a high-energy γ-ray telescope flown on the satellite SAS-2 in December 1972. The arrival time of each γ ray was compared with the radio pulse time using predicted pulse arrival times. Peaks occurred at the positions of the main and secondary radio pulses, and there was a constant component above the general background from the Crab region. The total flux of γ rays above 35 MeV was estimated to be $(15.8 \pm 4.2) \times 10^{-6}$ photons/cm^2/sec., and that of the pulsed component as $(6.2 \pm 2.8) \times 10^{-6}$ photons/cm^2/sec. Above 100 MeV the values were $(3.2 \pm 0.9) \times 10^{-6}$ and $(2.2 \pm 0.7) \times 10^{-6}$. The unpulsed component appeared to become a progressively smaller fraction of the total flux as the energy increased. The results are compared with those obtained for the Vela region, and the data ascribe a very different origin in the two cases, the Crab γ-radiation intensity resulting from the same mechanism as the x-ray emission and the Vela γ radiation resulting from the nucleonic component of the cosmic rays interacting with local matter. (UK)

12291 GAMMA-RAY BURSTS FROM NEUTRON STAR GLITCHES. Pacini, F. (Comitato Nazionale per l'Energia Nucleare, Frascati, Italy); Ruderman, M. Nature (London); 251: No. 5474, 399-400(4 Oct 1974).

The basic facts concerning the observed occurrence of what are termed "gamma ray bursts" are first enumerated, and it is proposed that the "bursts" arise from the abundant population of old and slowly spinning neutron stars no longer observable as pulsars. It is supposed that the "bursts" are emitted due to magnetospheric activity related to "glitches". It is estimated that within 10 pc 10^2 and possibly 10^3 old neutron stars can be expected, and the observed frequency of several "bursts" per year, and their intensities are compatible with the number of defunct pulsars if each emits, say, 10^{35} to 10^{36} ergs every 10 to 100 years. A considerable part of the energy released in a "glitch" probably causes a sudden change in the magnetospheric fields and leads to the production of fast particles. If the "bursts" arise near the surface of a neutron star and the emission is not highly collimated with the field lines, the proposed model accounts for the spectral range covered by the "bursts", and predicts a sharp cut-off at about 1 MeV. The considerations suggest a possible interpretation of the time structure of the "bursts". (UK)

12292 INTERPRETATION OF A HARD SOLAR X-RAY BURST. Hoyng, P.; Stevens, G. A. (Astronomical Inst., Utrecht). pp 97-102 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

An analysis is presented of the flare of May 18, 1972, UT 14:06, observed with the Utrecht hard solar x-ray spectrometer on board the ESRO satellite TD-1A. In this analysis, the pertinent gigahertz radio data of this event is included. The proton density in the source region is inferred to be at least 5 billions per cu cm. The radio spectra are found to agree with the calculations of Holt and Ramaty. The radio and x-ray data together result in a consistent set of parameters. (auth) (IAA)

12293 SEARCH FOR OPTICAL IDENTIFICATIONS IN THE 5C3-RADIO SURVEY. I. Observations. Richter, G. A. (Deutsche Akademie der Wissenschaften, Sonnenberg, Ger.); Richter, G. M.; Richter, L.; Richter, N. B. Astron. Nachr.; 295: No. 1, 19-26 (1974).

The investigation considered is based on M 31 plates obtained with a 134/200 cm Schmidt telescope. A table is presented showing the optical objects near the radio positions of the 5C3 survey. The table lists also the B-magnitudes and the colors U-B, B-V, and B-r. Differences between optical and radio positions are discussed, giving attention to systematic errors in the radio positions. The apparent magnitudes of the objects have been measured with a cat's eye photometer. An identification rate of about 10% is obtained. (IAA)

12294 PARKES 0548-322: A BL LACERTAE OBJECT IN A CLUSTER OF GALAXIES. Disney, M.J. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian

National University). Astrophys. J. Lett. 193: No. 3, L103-L105 (1 Nov 1974).

PKS 0548–322 has been identified as a BL Lacertae–type object superposed on a cluster of galaxies with redshift 0.04. It is argued that the object is a cluster member and that the lack of emission lines is explained by the anomalous nonthermal continuum. The object may be associated with the X–ray source 3U 0545–32. (auth)

12295 OH ABSORPTION IN THE RADIO SOURCE W51. I. OBSERVATIONS. Slysh, V.I. (Institute for Space Research, Academy of Sciences of the USSR, Moscow). Sov. Astron.–AJ 18: No. 3, 278-282 (Nov 1974).

The radio–source complex W51 has been mapped in the continuum and in the 1667– and 1665–MHz OH absorption lines with the large Nançay radio telescope (3.4×18′ beam). The spectral resolution was 20 kHz or 3.6 km/sec. Continuum and line antenna–temperature isophotes are presented, as well as contours in diagrams of radial velocity against right ascension. Maser emission is found at 1667–MHz; its source coincides with the 1665–MHz maser source. The 1667–MHz maser emission is 100% right–circularly polarized. (auth)

Solar Phenomena

Refer also to abstracts 11052, 12225, 12241, 12403, 12428, 12446, 12451, and 13118.

12296 DISTRIBUTION BY HELIOGRAPHIC LATITUDE OF THE REMARKABLE PROTUBERANCES IN THE TWO HEMISPHERES OF THE SUN IN THE 11-YEAR CYCLES NO. 18 AND NO. 19 OF SOLAR ACTIVITY. Bonov, A.; Dermendziev, V. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 21-31(1972). (In Russian).

In accordance of data on the 11-year cycles No. 18 and No. 19 the distribution by heliographic latitude of the remarkable protuberances which have great altitudes was studied. The protuberances were distributed into 4 groups: $h \leq 50.10^3$km, $50.10^3 \leq h \leq 75^3$km, $75.10^3 \leq h \leq 100.10^3$km, and $k > 100.10^3$km. The following regularities were established: The higher protuberances are observed in greater heliographic latitudes and in both hemispheres of the sun. In the polar zone (from 60 to 90°), and for the two 11-year cycles, the protuberances at all the altitudes examined are only in the northern hemisphere of the sun. The distribution of the filaments which cross the solar equator were also studied. It was found that in cycle No. 18 the filaments which correspond to protuberances that are over 75.10^3 km high are observed in the ascending branch of the cycle. The situation in cycle No. 19 is the reverse: such filaments are observed only in its descending branch. (tr-auth)

12297 DEPENDENCES BETWEEN THE ELEMENTS OF THE 22-YEAR CYCLE OF SOLAR ACTIVITY. Bonov, A. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 41-46(1972). (In Russian).

The existence of a dependence between the characteristic elements of the even-spot 11-year cycle and the characteristic elements of the 22-year cycle was studied. It was established: That between the ϕ_{2n} phase of the maximum in the even-spot 11-year cycle and the general power of the 22-year cycle, i.e., the sum $W_s = W^M_{2n} + W^M_{2n+1}$ of Wolf's numbers in the epochs of the maximums of the even and odd 11-year cycle there exists the empirical dependence: $W_s = W^M_{2n} + W^M_{2n+1} = 531 - 761\ \phi_{2n}$. That between ϕ_{2n} and the sum of the area of the cyclic curves of the two 11-year cycles $\Sigma_s W = \Sigma W_{2n} + \Sigma W^M_{2n+1}$ there exists the empirical dependence: $\Sigma_s W = \Sigma W_{2n} + \Sigma W_{2n+1} = 2534 - 3521\ \phi_{2n}$. These two dependences show that a physical link exists between the even and the odd 11-year cycles which make up the 22-year cycle. When an odd and an even 11-year cycle are grouped into a 22-year cycle, such a link does not exist. (tr-auth)

12298 NONSPHERICAL MAGNETIZED SOLAR WIND. Sroczynska, M. (Institute of Astronomy, Warsaw). Acta Astron.; 24: No. 2, 165-188(1974).

Stationary axisymmetric, three-dimensional models of a magnetized solar wind are studied by the standard small-perturbation technique. The zero-order model is represented by a spherically symmetric Parker's solution with a polytropic formula instead of the energy equation. For certain boundary conditions imposed upon the flow it is possible to obtain models of the solar wind which exhibit a tendency to blow faster near the poles than near the equator, in agreement with observational data. A method of describing the contribution to nonspherical deviations of the solar wind due to the Sun's active centers is also proposed. (auth)

12299 SOLAR FLARES. Michard, A. (Observatory de Paris). Recherche (Paris); 5: 616-625(1974). (In French).

A flare is an optical phenomenon of large magnitude in the solar chromosphere. It is also an intense source of certain radiation which the Sun does not emit in normal times except in minute quantities: these radiations place themselves at the two ends of the spectrum, Hertzian waves and x rays. It is still an "accelerator" of energetic particles, analogous to the giant machines (cyclotrons, synchrotrons) of nuclear physics. It is, then, a "deflagration" of which the shock waves propagate themselves in the solar atmosphere and the interplanetary medium. Brilliant "points" of several billions of square kilometers, and the reaction of the chromosphere to an excess of energy are discussed. Attention is given to particles ejected in interplanetary space, and the importance of the magnetic field to flares. (IAA)

12300 EMPIRICAL SOLAR PROTON MODEL FOR ORBITING SPACECRAFT APPLICATIONS. Stassinopoulos, E. G.; King, J. H. (Goddard Space Flight Center, Greenbelt, MD). IEEE Trans. Aerospace; AES 10: 442-450(Jul 1974).

An empirical model for energetic solar proton fluxes is presented. With this model the effects of such protons on geocentric space missions, to be flown during the next solar active period (1977-1983), and with orbits involving partial magnetospheric shielding, may be estimated. A synoptic background review is given, followed by a detailed discussion of the model's use, errors, uncertainties, and limitations, including sample calculations which demonstrate the application of specific or general project missions. Finally, for circular trajectories, percentage exposure maps are presented, depicting fractional mission times spent outside particular L shells as functions of orbit altitude and inclination. (auth)

12301 ORIGIN OF ELECTRON STREAMS GENERATING HERRING-BONE STRUCTURE OF TYPE II BURSTS. Zaitsev, V. V.; Stepanov, A. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Novosibirsk, USSR). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 8, 1229-1239(1974). (In Russian).

A model is discussed of a herring-bone-structure of Type II bursts; the radio emission is produced by superthermal electron streams accelerated in the front of a collisionless shock wave. The electron heating and acceleration occurring in the development of Buneman instability is analyzed using the quasilinear theory equations. The inhomogeneity of the shock-wave front which may have a stabilizing influence on the instability is taken into account. Based on the suggested model, some parameters of electron streams generating herring-bone-structure are estimated. (auth)

12302 SOLAR CHROMOSPHERE. Bray, R. J.; Loughhead, R. E. International Astrophysics Series. New York; John Wiley and Sons, Inc. (1974). 401p. $30.00.

An attempt is made to give a comprehensive description of the theoretical understanding and observational knowledge of the chromosphere. Topics considered include: historical introduction; spicules and other fine structures at the solar limb; morphology and dynamics of the quiet chromosphere observed on the disk; physical conditions in the quiet chromosphere; fine structure of the active chromosphere; propagation and dissipation of waves in a compressible gravitationally-stratified atmosphere; and theories of the heating of the chromosphere and of the origin of spicules. (WDM)

12303 SOLAR-TERRESTRIAL DISTURBANCES OF 15 AUGUST 1972. Simultaneous Measurement of Intensities and Phase of Loran-C Waves. Ouchi, C.; Fujii, S.; Wakai, N. (Radio Research Lab., Nakaminato, Japan). Denpa Kenkyusho Kiho; 19: No. 103, 367-372(Jul 1973). (In Japanese).

The intensities and phase of Loran-C (100 kHz) waves observed at Hiraiso exhibited several remarkable responses to unusually high solar activity which occurred early in August 1972. Outstanding SFA's (sudden field anomalies) in the signal from four Loran-C transmitters encircling Hiraiso as well as corresponding SPA's (sudden phase anomalies) in the Master (Iwojima) signal are presented. The preliminary analysis of those records visualizes the transition of electron concentration in the D region in association with the solar x-ray bursts. (auth)

12304 KHARAKTER SOLNECHNO-ATMOSFERNYKH SVIAZEI. (Nature of Sun-Atmosphere Relations). Loginov, V. F. Leningrad; Gidrometeoizdat (1973). 48p.

It is proposed that the limited nature of present indices of solar activity is the main reason for the failure to find consistent correlations between meteorological processes and solar activity. A new index for solar wave radiation is presented, based on relationships of brightness and area of sunspots, faculae, and bright rings. This index describes sufficiently well the secular variation of direct radiation and the global characteristics of general atmospheric circulation. An index for corpuscular radiation is constructed on the basis of area and height of sunspots. These two indices together form a combined index which makes manifest

correlations between solar activity and atmospheric processes. (IAA)

12305 RESONANCE STRUCTURE OF THE SOLAR SYSTEM. Molchanov, A. M. pp 32-42 of Current Problems in Celestial Mechanics and Astrodynamics. Moscow; Izdatel'stvo Nauka (1973). (In Russian).

An estimation was made of the degree of closeness of the real solar system to a theoretical, exactly resonant system. In this study an important role is played by the concept of "well" resonant systems, in which the whole-number resonance matrix has small coefficients. The neighborhood of a theoretical system which contains all systems lagging behind the theoretical system by a distance no greater than the solar system is considered. Such a neighborhood is constructed around each "good" system, and a set of systems "no poorer than the solar system" is formed. It is shown that the total volume of all such systems is extremely small. This circumstance cannot be attributed to randomness but must have an evolutionary explanation. It is concluded that the theory of perturbations of Hamiltonian systems cannot be applied to the problem of the structure of the solar system, since the "common position" hypothesis which is the basis of this theory is not satisfied. To understand the structure of the solar system, a theory of resonance solutions of multifrequency systems must be created. (IAA)

12306 MAGNETOACOUSTIC INSTABILITY AND TERMINATION OF SOLAR WIND. Buti, B. (Space Physics Division, Ames Research Center, NASA, Moffet Field, California). Astrophys. J. 192: No. 3, 757-767 (15 Sept 1974).

Stability of a system composed of two interstreaming plasmas in the presence of a transverse magnetic field is investigated, and the theory is applied to solar-wind interaction with interplanetary gas. The system is susceptible to magnetoacoustic instability provided $\alpha < \alpha_c$, where α is the ratio of densities of solar-wind protons to interplanetary protons and α_c is the critical value at which this instability is excited. The turbulence produced by this instability will reduce the solar-wind speeds to subsonic values. This transition for the solar wind occurs in the range $5 < r < 20$ (r being the heliocentric distance in a.u.). (auth)

12307 RESONANCE-LINE TRANSFER WITH PARTIAL REDISTRIBUTION: II. THE SOLAR Mg II LINES. Milkey, R. W. (Kitt Peak National Observatory, Tucson, Arizona); Mihalas, D. Astrophys. J. 192: No. 3, 769-776 (15 Sept 1974).

Line profiles for the Mg II h and k lines have been calculated, accounting for the partial frequency redistribution of photons. These profiles are compared with the complete redistribution calculations under identical assumptions for the atomic atmospheric models, and the inadequacy of the latter approximation is demonstrated. In particular, the temperature as deduced from the intensities at h_1 and k_1 under the assumption of complete redistribution appears to be a lower limit for the chromospheric temperature minimum. The partial redistriution profiles are in substantially better agreement with observation than complete redistribution results in describing the wavelength position of h_1 and k_1, and the relative behavior of the h and k profiles. (auth)

12308 THE SMALL-SCALE, QUASI-PERIODIC, DISK COMPONENT OF SOLAR RADIO RADIATION. Lang, K.R. (Downs Laboratory of Physics, California Institute of Technology, Pasadena). Astrophys. J. 192: No. 3, 777-786 (15 Sept 1974).

Interferometric observations of the Sun at wavelengths of 3.7 and 11 cm show that small-scale, quasi-periodic radio emission is coming from the Sun. The periods, P, occur in a band of periods with a midband frequency of 3.75 mHz (or P=266 s) and a bandwidth of 2.5 mHz ($200\ s \lesssim P \lesssim 400\ s$). The peak-to-peak fluctuations in brightness temperature, ΔT, lie in the range $4 \times 10^{3\,6} \lesssim \Delta T \lesssim 5 \times 10^5$ °K. The radio emission is $\lesssim 10$ percent linearly or circularly polarized; and the angular size of the emitting regions is of the order of 10'. The radio emission originates at the base of the chromosphere-corona transition region at approximately 2200 km above the level at which the optical depth at 5000 Å is unity. (auth)

12309 NUCLEAR REACTIONS IN SOLAR FLARES DISCOVERED. Krivsky, L. (Ceskoslovenska Akademie Ved, Ondrejov, Astronomicky Ustav). Vesmir; 52: No. 9, 281(1973). (In Czech).

A brief list is presented of works confirming the occurrence of nuclear reactions in solar flares. (INIS)

12310 RADIATION BELT. Das, A. C. (Physical Research Lab., Ahmedabad, India). pp 283-312 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Consideration of the dynamics of particles and fields inside the radiation belt is presented. There are enough observations of both particles and fields, and it is possible to make suitable models. The theory of adiabatic invariants, which is applicable inside the radiation belt because of small changes in magnetic field, is discussed. The collisions are neglected, and the only perturbations which affect the trajectory of the particles are the electromagnetic waves. The disturbances which change the adiabatic invariants are discussed briefly. A gyroresonance mechanism is studied for a whistler-mode wave, and it is shown that the particle changes its pitch angle and as a result loses energy when it moves from high pitch angle to low pitch angle, while it gains energy when the motion is directed from low pitch angle to high pitch angle. (auth)

12311 SOLAR WIND. Bhatia, V. B. (Univ. of Delhi). pp 159-180 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

A review of the magnetohydrodynamical theories of the solar wind is presented. The stress is more on physical theory than on mathematical details. First those models are discussed which do not take into account the existence of the magnetic field in the corona. Then models incorporating magnetic field and rotation are reviewed. Viscous effects on the expansion of the corona are taken up next. Finally, two-fluid models are considered. An attempt was made throughout to point out the shortcomings of the various approaches to the problem of the coronal expansion into a solar wind. (auth)

12312 INSTABILITIES IN THE SOLAR WIND. Tandon, J. N. (Univ. of Delhi). pp 181-205 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Fluid dynamical models appear to explain the transition from a nearly static corona to the supersonic solar wind; however, the conventional fluid equations are not valid when the mean free paths become large. In interplanetary space, the solar wind represents a collisionless magnetized plasma, and various plasma instabilities come into play as wave-particle interactions replace particle-particle scattering. Theoretical considerations of instabilities in the solar wind and recent observations in so far as the observations bear directly on the theoretical problems are considered. (auth)

12313 INTERACTION OF THE SOLAR WIND WITH CELESTIAL OBJECTS. Dryer, M. (National Oceanic and Atmospheric Administration, Boulder, CO). pp 206-221 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

The rationale for the hypersonic analog approach to the problem of the solar wind flow around celestial objects is reviewed. Emphasis is given to the continuum analysis primarily because it has proved to be successful for earth as well as, in all probability, Mars and Venus. Utilization of this approach is therefore recommended for some of the outer planets for the purpose of defining the gross features of the interaction dynamics such as shock wave shapes and magnetosheath properties. Interaction of the solar wind with smaller obstacles may require more fundamental kinetic analyses which involve solution of some approximation to the Boltzmann equation. Preliminary studies (possibly applicable to Pluto and some asteroids) suggest that shock wave-like density gradients develop near the obstacle's limb. (auth)

12314 STUDY OF SOLAR X-RAY FLARES. Sengupta, P. R. (Tripura Engineering Coll., India). pp 77-127 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

After a detailed study of 2200 solar x-ray flares in 0 to 5.3, 1 to 8, 2 to 12, and 8 to 20 A ranges with peak 2 to 12 A flux greater than 4 milliergs per sq cm sec or peak 1 to 8 A flux greater than 2 milliergs per sq cm sec recorded during a period of four years from July, 1966 to June, 1970, it is concluded that the x-ray flares may be divided into three different types depending on their nature and origin. It is further concluded that the x-ray flares, in general, originate in the active regions of the sun. The flare emission and the hardness of the flare spectrum are found to be related to the intensity of the associated active region. Association of the three different types of x-ray flares with solar optical flares, radio bursts and particle events are studied in detail. Probable flare emission mechanisms are suggested. (auth)

12315 SOLAR FLARE X-RAYS. Deshpande, S. D. (Coll. of Engineering, Aurangabad, India). pp 128-150 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Solar flare x-ray emission in the wavelength range 0.5 to 12 A is of special interest because its spectral distribution is highly sensitive to the temperatures in the emitting solar regions, and it is directly responsible for the flare time excess ionization in the earth's lower ionosphere. A large amount of data on integrated x-ray intensity measurements in various bands and some spectral measurements, which have become available from satellite-borne experiments, are subjected to a statistical examination. Analysis of suitable spectral data to obtain x-ray source temperatures and emission measures were also attempted. Nature of the x-ray event in 0.5 to 12 A range changes from a short duration burst at shorter wavelength end to an enhancement of gradual rise and fall type towards longer wavelength end. (auth)

12316 SOME STUDIES ON SOLAR MICROWAVE BURSTS. Das Gupta, M. K.; Sarkar, S. K. (Univ. of Calcutta). pp 56-76 of Solar

Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Some of the aspects of the different types of solar microwave bursts were examined for a period of about three years covering the peak phase of the current solar cycle. These include their occurrences, peak flux and energy excess spectra and association with the slowly varying component and also with the different classes of H-alpha flares. Important results obtained from the present statistical analysis are: simple impulsive type of bursts were found to be the most predominant as regards occurrences at any single frequency, simultaneous occurrences over a wide band of frequencies, and association with the slowly varying component; occurrences of the different types of bursts show two definite categories of frequency dependences—those having maximum occurrences at 4995 MHz and those having progressively higher occurrences at lower frequencies; occurrences and energy excesses of the common types of bursts show marked 27-day variation similar to that of the slowly varying component. (auth)

12317 HARD X-RAYS AND EUV RADIATION FROM SOLAR FLARES. Bhatia, V. B. (Univ. of Delhi). pp 46-55 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

The characteristics of the hard x-ray and the EUV radiation from solar flares are described. The inverse Compton process, as applicable to the astrophysical systems, is reviewed. It is suggested that the hard x-rays and the EUV radiation are emitted by the same stream of electrons through the inverse Compton process and the synchrotron radiation respectively. Model calculations for the flare of 1816 UT, 1968 August 8 are presented in support of this suggestion. (auth)

12318 SOLAR FLARES. Tandon, J. N. (Univ. of Delhi). pp 25-45 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

A review of solar flare electromagnetic radiation is presented. The correlation of x-rays, EUV flashes, and microwave radiation is studied. A model to explain these radiations is developed. It is proposed that hard x-rays and EUV flashes result from highly energetic electron beams moving downward from the site of the flare region through inverse Compton process and synchrotron radiation respectively, while microwave radiation is emitted through coherent plasma radiation resulting from upward moving electron beams. Further, the soft x-rays can be accounted by thermal bremsstrahlung. (auth)

12319 COMMENTS ON PAPER "THE SOLAR WIND CYCLE, THE SUNSPOT CYCLE AND THE CORONA" BY J. HIRSHBERG. Diodato, L.; Moreno, G. (Consiglio Nazionale delle Ricerche, Rome (Italy). Lab. Plasma nello Spazio). Astrophys. Space Sci.; 28: No. 1, L7-L10(May 1974).

Hirshberg (1973) has discussed the long-term variations of the solar wind bulk speed and interplanetary magnetic field, in connection with the sunspot cycle and the coronal activity. Bulk velocity measurements in the period 1962–1970, previously collected by Gosling (1971), were interpreted by Hirshberg in terms of a "solar wind cycle" out of phase with respect to the sunspot cycle. The present note checks the real existence of the bulk velocity modulation proposed by Hirshberg, taking advantage of the intercalibrations among a number of plasma experiments recently performed by Moreno and Signorini (1973). (auth)

12320 PROCEEDINGS OF THE FIRST EUROPEAN ASTRONOMICAL MEETING. Volume 1. Solar Activity and Related Interplanetary and Terrestrial Phenomena. Conference held at Athens, Greece, September 4–9, 1972. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973). 210p. (CONF-7209122-). $38.40.

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972).

Separate abstracts were prepared for fifteen of the papers. (WDM)

For abstracts of individual papers see: 12292 and 12321–12334.

12321 INTERPLANETARY SOLAR PHENOMENA. de Feiter, L. D. (Astronomical Inst., Utrecht). pp 1-11 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

In this review special emphasis has been given to those interplanetary phenomena that are of specific relevance to the physics of the solar corona. The topics discussed are: thermodynamic solar wind characteristics, solar wind composition, interplanetary magnetic field and solar active regions related to interplanetary structures. (auth) (IAA)

12322 SOLAR FLARES DURING THE PAST 1000 YEARS AS REVEALED BY LUNAR STUDIES. Fireman, E. L. (Smithsonian Astrophysical Observatory, Cambridge, MA). pp 12-19 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The intensities of proton fluxes of energy greater than 50 MeV in several recent solar flares are obtained from measurements of ^{37}Ar radioactivity as a function of depth in lunar material. These intensities agree within a factor of 2 with measurements made by detectors aboard satellites. The intensities of the solar proton fluxes of greater than 200-MeV and greater than 50-MeV energy averaged over the past 1000 years are estimated from measurements of ^{39}Ar radioactivity as a function of depth in lunar material. The intensity of greater than 200-MeV solar-flare protons obtained from ^{39}Ar in Fe, when averaged over the past 1000 years, was equal to that of galactic cosmic rays. This result indicates that the 19th solar cycle, which had a number of very energetic solar flares, was more typical of solar activity during the past 1000 years than was the 20th. (auth) (IAA)

12323 SOLAR ACTIVITY AND PRECIPITATION. Xanthakis, J. (Research Center for Astronomy and Applied Mathematics, Athens). pp 20-48 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The correlation between solar activity and the annual precipitation level is studied, using the areas index instead of the relative sunspot number generally taken as the index of solar activity. The areas index is defined by a relation in which the areas of sunspots and faculae are corrected for foreshortening. A comparison of the values of the areas index with the corresponding mean zonal annual precipitation at different zones on the Earth's surface indicates that there exists a quite satisfactory correlation, positive or negative, the correlation coefficient varying between 0.60 and 0.87. (IAA)

12324 STUDY OF THE AREAS INDEX I_a. Poulakos, C.; Tritakis, B. (Research Center for Astronomy and Applied Mathematics, Athens). pp 49-60 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

A relation which describes the variation of the mean annual value of the areas index within each sunspot cycle as a function of the rise time is derived, together with a relation which describes the mean annual values of the areas index as a function of the mean annual values of the mean relative sunspot number. The absence of seasonal variations of the areas index and of the relative sunspot number during even sunspot cycles is established. (IAA)

12325 SOLAR ACTIVITY CYCLE AND THE BREATHING OF THE HELIOSPHERE. Fahr, H. J. (Univ., Bonn). pp 61-74 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

Interstellar helium and hydrogen enter the solar system from a specific direction of the interstellar space and suffer loss processes due to ionization and charge exchange reactions. The geometry of the cavity of ionized matter is determined by the effects of macroscopic streaming, extinction along hyperbolic orbits and gravitational focusing. Whereas the helium cavity turns out to be similar to a sphere which is strongly cusped in the direction opposite to the approach of interstellar matter, the hydrogen cavity resembles a sphere largely elongated in that direction. Since both the solar euv-fluxes below 912 and 504 A and the solar resonance line fluxes at 126 and 584 A vary appreciably during the 11-year solar activity cycle, both geometries and dimensions of the helium and hydrogen cavities show pronounced solar cycle-correlated variations. Connected with these variations are variations of the solar-wind dynamics, especially of the solar-wind kinetic energy flux in the outer heliospheric regions. (auth) (IAA)

12326 EVIDENCE OF A DOUBLE PEAK IN SOLAR MAXIMA. Papagiannis, M. D. (Univ. of Athens); Zerefos, C. S.; Reparis, C. C. pp 75-82 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The latitudes of solar flares accompanied by Type-IV radio bursts during the maxima of cycles 19 and 20 are analyzed. Solar maxima for the higher-energy events are found to contain two independent peaks—a stronger one at higher latitudes and a weaker one at lower latitudes. Intensification of the two-peak structures in events with higher energies is observed during the solar activity maxima. (IAA)

12327 CHARACTERISTIC FEATURES OF SECULAR AND SUPERSECULAR CYCLES OF SOLAR ACTIVITY. A 180-Year Cycle. Bonov, A. D. (Univ. of Sofia). pp 83-86 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

Both 11-year cycles, the even and the odd ones according to the Zurich numeration, form a whole, i.e., the 22-year cycle of the solar activity. Therefore, they cannot be separated the one from the other. This is why the secular and the super-secular cycles of solar activity must necessarily begin with an even 11-year and must end with an odd 11-year cycle. The author has found a 180-year cycle. On this basis, he draws the conclusion that until the end of the 20th century the solar activity will decrease considerably in comparison with its level at the 22-year cycle (18–19). (auth) (IAA)

12328 INTENSITY OF THE PENUMBRA OF SUNSPOTS. Eriksen, G.; Maltby, P. (Univ. of Oslo). pp 87-92 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The results of the observations of penumbral intensities obtained by pinhole photometers during 1967–1972 are presented. The pinhole photometers and the method of observation are briefly described. Comparison with the results given by other authors suggests that the reference published by Wohl et al. (1970) gives intensity values which are too low, particularly for wavelengths below 0.550 micron. (auth) (IAA)

12329 SOLAR FLARES, SUPRATHERMAL PLASMA NODULES, AND LOOP PROMINENCES. de Feiter, L. D.; de Jager, C. (Astronomical Inst., Utrecht). pp 93-96 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The small bright points visible on x-ray heliographs with fairly high resolution are described; they are called suprathermal plasma nodules. They seem to be due to the storage, in a magnetically confined region, of plasma (about 1 keV) produced by a series of solar flares. If the storage energy exceeds a certain limit, the magnetic structure disrupts and expands, leading to features like loop prominences. This model can be confirmed by some numerical estimates. (auth) (IAA)

12330 HARD SOLAR X-RAY SPECTROMETER ON BOARD THE ESRO TD-1A SATELLITE. van Beek, H. F.; de Feiter, L. D. (Astronomical Inst., Utrecht). pp 103-109 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The solar hard x-ray spectrometer on board the ESRO TD-1A satellite (launched on Mar. 12, 1972) aims at measuring x rays in the energy range from 24 to 900 keV. This energy range is divided into twelve approximately logarithmically spaced energy channels. Continuous pointing at the Sun provides the possibility for a fine time resolution, which has been set at 1.2 sec for the 4 channels between 24 and 90 keV and 4.8 sec for the others. Careful rejection of background radiation and very accurate preflight and inflight calibration add to the reliability of the observations. The paper describes the instrument and its characteristics. (auth) (IAA)

12331 DETAILED PHOTOMETRICAL STUDY OF THE DEVELOPMENT OF A FLARE FROM Hα OBSERVATIONS. Falciani, R.; Rigutti, M. (Capodimonte Observatory, Naples). pp 110-111 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

A total of roughly two thousand Hα line spectrograms with six to ten isophotographs of fixed intensity for each spectrogram were obtained at the National Observatory in Athens. A summary of information inferred from an analysis of the spectrograms is given. Correlations between the Hα features and x-ray and radio emissions at different wavelengths are considered. (IAA)

12332 UNUSUAL BURST OF ACTIVITY ASSOCIATED WITH McMATH REGION 10789 ON JUNE 13, 14, 1970. Fokker, A. D. (Univ., Utrecht). pp 117-119 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

The solar radio burst activity associated with McMath region 10,789 on June 13 and 14, 1970 was a subject of cooperative study initiated by the Committee of European Solar Radio Astronomers (Carrigan et al., 1973). The findings are briefly summarized in this paper. (auth) (IAA)

12333 IONIZATION AND RECOMBINATION PROCESSES FOR NONTHERMAL PLASMAS. Landini, M.; Fossi, B. C.; Pallavicini, R. (Arcetri Astrophysical Observatory, Florence). pp 120-122 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

X-ray emission from solar flares in the spectral region 1 to 10 keV is usually interpreted as being produced by a thermal plasma at several million degrees of temperature. Isothermal models of flares cannot explain line emission at these photon energies, and multi-temperature models are required (Meekins et al., 1970; Neupert, 1971). Broad-band ion-chamber measurements indicate that at low-energies some x-ray bursts may be nonthermal in nature (Landini et al., 1972), or at least a nonthermal emission component may be present (Kahler and Kreplin, 1971). For these reasons, ionization and recombination processes have been investigated for a plasma whose electrons follow a non-Maxwellian energy distribution. (auth) (IAA)

12334 SOME DETAILS OF THE SUPERGRANULAR MOTION. Kubicela, A. (Astronomical Observatory, Belgrade). pp 123-130 of Proceedings of the First European Astronomical Meeting. Vol. 1. Xanthakis, J. (ed.). Berlin; Springer-Verlag (1973).

From 1st European astronomical meeting on solar activity and related interplanetary and terrestrial phenomena; Athens, Greece (4 Sep 1972). See CONF-7209122-.

A low-noise spectrographic evaluation of supergranular velocities reveals: (1) a sight-line velocity distribution within the supergranules which is explained by the presence of Coriolis velocities, and (2) some places where, after an enhancement of approaching sight-line velocities, a typical supergranular velocity distribution evolves; this is probably how the cells are born. The Ca II K-232 emission in most cases follows the supergranular flow. (auth) (IAA)

12335 GENERATION OF CHARGED PARTICLES BY THE SUN ON JULY 22, 1972. Grigor'eva, V. P.; Kudryavtsev, M. V.; Kurt, V. G.; Logachev, Yu. I.; Melioranskii, A. S.; Pisarenko, N. F.; Savenko, I. A.; Shamolin, V. M.; Shestopalov, I. P. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 194-198(1974).

Translated from Kosm. Issled.; 12: No. 2, 213-218(1974).

The increase of electron intensity of solar cosmic rays and the bursts of electromagnetic radiations, measured by the Prognoz 1 and Prognoz 2 satellites on July 22, 1972 are considered. It is shown that an optical flare occurred behind the western rim of the Sun and that the shock wave generated by this flare caused an additional acceleration of charged particles in a region remote from the site of the primary flare. (auth)

12336 FLOW OF THE SOLAR WIND AROUND MARS AND VENUS. General Principles. Vaisberg, O. L.; Bogdanov, A. V. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 253-257(1974).

Translated from Kosm. Issled.; 12: No. 2, 279-284(1974).

Measurements of the ion component of the plasma made on board Mars 2 and Mars 3 made it possible to record the bow shock wave and indicated the possibility of the existence of a boundary layer near Mars. The hypothesis that a boundary layer exists near Venus has been expressed before. A comparison of the Mars 2 and Mars 3 data with measurements conducted aboard Venera 4 and Mariner 5 permitted a reinterpretation of the mea-

surements near Venus and the obtaining of data in favor of the existence of boundary layers near Venus and Mars. (auth)

12337 LOW-ENERGY PROTON MEASUREMENTS WITH THE SATELLITE PROGNOZ. Bednyakov, A. A.; Logachev, Yu. I.; Ryumin, S. P.; Savenko, I. A.; Stolboushkin, S. K.; Shestopalov, I. P. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 288-290 (1974).

Translated from Kosm. Issled.; 12: No. 2, 312-314(1974).

The measurement of proton fluxes and spectra in the energy range of tens and hundreds of keV is a very important problem. These low-energy protons carry the greater part of the energy of the total flux of solar protons. If the differential solar proton spectrum is denoted as $E^{-\gamma}$ with $\gamma = 3$, then of the total flux of protons with energy greater than 30 keV, 97% of the energy is contained in protons with energies from 30 keV to 1 MeV. Moreover, a study of such protons can give valuable information on the processes of low-energy proton acceleration in the Sun and the interplanetary medium, and on the fine structure of the interplanetary magnetic field, because of the low Larmor radius of such particles. The fact that until the present protons with energies less than 500 keV have remained practically unexamined can be explained by certain technological difficulties. These difficulties are basically related to the low signal level from the detector and the low path length of such particles in matter. A low-noise semiconductor detector is described which resolves these difficulties, and preliminary results obtained with the detector aboard the satellite Prognoz are given. (auth)

12338 EXTREME-ULTRAVIOLET OBSERVATIONS OF SUNSPOTS WITH THE HARVARD SPECTROMETER ON THE APOLLO TELESCOPE MOUNT. Foukal, P.V.; Huber, M.C.E.; Noyes, R.W.; Reeves, E.M.; Schmahl, E.J.; Timothy, J.G.; Vernazza, J.E.; Withbroe, G.L. (Center for Astrophysics, Cambridge, Massachusetts). Astrophys. J. Lett. 193: No. 3, L143-L145 (1 Nov 1974).

EUV spectroheliograms show that the areas directly above sunspot umbrae are the brightest features in an active region by an order of magnitude in the chromosphere-corona transition region (10^{5}°K < T < 10^{6}°K.) Ratios of density-sensitive lines in the transition region show a significant decrease in gas density over the umbra relative to surrounding plage. We deduce that the temperature gradient in the transition region over the spot is decreased by an order of magnitude or more, relative to the plage. (auth)

12339 THE ENIGMATIC PERIODICITY OF THE SOLAR OBLATENESS. Dicke, R. H. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Solar Phys.; 37: No. 2, 271-299(Aug 1974).

The complex wave-form of the 25⅓ day periodicity of the solar oblateness is exhibited. The statistical significance and strength of the fluctuation is examined. Using several lines of evidence the periodic fluctuation is shown to be a fluctuation in shape, not brightness. The fluctuation does not correlate with indicators of sunspots, faculae, prominences, or magnetic fields. The detailed results of the analysis of the correlation with faculae are given. A possible explanation for the absence of the negative-correlated fluctuation delayed by ½ the period is examined. (auth)

12340 CHROMOSPHERIC GRANULATION. Giovanelli, R. G. (National Standards Lab., Sydney (Australia)). Solar Phys.; 37: No. 2, 301-307(Aug 1974).

Photographs obtained in the core of Hα, free of parasitic continuum radiation, reveal a granular structure in supergranule centers wherever not obscured by mottles or fibrils. Granulation is seen well in the wings out to ±0.5 Å from line center, the contrasts being largely reversed in opposite wings. The granule diameters (from boundary to boundary) are observed down to 800 km, and are typically 1200 km, both probably upper limits imposed by telescope resolution. At 0.25 Å, the intensity fluctuates over a greater range (some 14%) in the blue wing than in the red (about 10%). The fluctuation is only 4% at line center. This smaller value represents a real variation at the local line center, whereas the appearance of granulation in the wings reflects to a large extent Doppler shifts due to vertical velocities. There is a tendency for the bright features at line center to be moving downwards. While of similar sizes, there is no direct superposition of chromospheric over photospheric granules. (auth)

12341 HIGH RESOLUTION SPECTROSCOPY OF THE DISK CHROMOSPHERE. III. Upward Moving Disturbances as Observed in the Ca II K-Line Wings. Beckers, J. M.; Artzner, G. (Sacramento Peak Observatory, Air Force Cambridge Research Laboratories, Sunspot, N. M. 88349, U.S.A.). Solar Phys.; 37: No. 2, 309-315(Aug 1974).

The properties of dark structures which are seen in the K-line wings and which seem to propagate inward into the K-line core, or upward in the solar atmosphere are described. These so-called dark whiskers appear to be related to the bright disturbances (bright whiskers) described by Liu (1974). Both may be related to the shocks that heat the chromosphere and corona. (auth)

12342 A THREE-COMPONENT CONCEPT OF THE CHROMOSPHERE AND TRANSITION REGION. Foukal, P. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). Solar Phys.; 37: No. 2, 317-321(Aug 1974).

It is proposed that present observations of the chromosphere and transition region in euv, optical, and mm wavelengths are best described by a three-component concept. The three components are taken to be: the interiors of supergranular cells, the hot plagettes overlying faculae, and the cooler, transient mottles which surround them in the network boundaries. The enhanced emission of the hot plagettes in transition ions is interpreted as a direct result of the increased pressure scale height over faculae relative to the cell interiors. (auth)

12343 MAGNETIC FIELD AND ELECTRIC CURRENT STRUCTURE IN THE CHROMOSPHERE. Dravins, D. (Hale Observatories, Pasadena, Calif. (USA)). Solar Phys.; 37: No. 2, 323-342(Aug 1974).

Three dimensional vector magnetic field structure throughout the chromosphere above an active region is deduced by combining high resolution Hα filtergrams with a simultaneous digital magnetogram. An analog model of the field is made with 400 metal wires representing fieldlines which are assumed to outline the Hα structure. The height extent of the field is determined from vertical field gradient observations around sunspots, from observed fibril heights and from an assumption that the sources of the field should be largely local. After digitization the magnetic field H matrix is retrieved. Electric current densities j are computed from j = curl H. The currents (typically 10 mA m^{-2}) flow in patterns not similar to observed features and not parallel to magnetic fields. Lorentz forces are computed from $F = j \times \mu_0 H$. The force structures correspond to observed solar features and a series of observed dynamics may be expected: downward motion in bipolar areas in lower chromosphere, an outflow of the outer chromosphere into the corona with radially outward flow above bipolar plage regions (where coronal streamers are observed) and motions of arch filament systems. Observed current structure and magnitude agree well with previous vector magnetograph observations but disagree with theoretical current-free or force-free concepts. A dynamic chromosphere with electromagnetic forces in action is thus inferred from observations. (auth)

12344 A MULTI-SLIT SPECTROGRAPH AND Hα DOPPLER SYSTEM. Martin, S. F.; Ramsey, H. E.; Carroll, G. A.; Martin, D. C. (Lockheed Solar Observatory, Saugus, California, USA). Solar Phys.; 37: No. 2, 343-350(Aug 1974).

A multiple entrance slit spectrograph was built for time-lapse photography of the spectra of flares and other transient solar phenomena. This spectrograph employs narrow-band filters to limit the wavelength range of the spectrograph to several angstroms centered at Hα or other spectral lines. The passband of the filter and the dispersion of the spectrograph determine the number of parallel slits through which light may be passed to achieve multiple adjacent spectral displays. By using a 7 Å filter, a dispersion of 10.8 Å mm^{-1}, and 35 mm film, adjacent Hα spectra are imaged from 30 parallel slits. A system of mirrors and relay lenses transfers the slitjaw image to the same film plane as the spectral image. A 2 frame camera is used to simultaneously record both images on adjacent frames. Filtering of the reference spatial image to 1.0 Å allows the observer to see the position of the slits relative to the Hα centerline structure and to match the brightness of the spatial image to the spectral display. A polarizing beamsplitter, prior to the slits, provides a prefiltered second solar image to a narrow band Hα Doppler filter for simultaneous photography in the wings of the Hα line. The multislit monochromatic spectrograph and Hα Doppler system constitute a flexible instrument in which components may be substituted to achieve different passbands width, image scales, dispersions, and corresponding numbers and spacings of adjacent spectra at a selected wavelength. (auth)

12345 THE MAXIMUM POLARIZATION FOR RESONANCE SCATTERING. Beckers, J. M. (Sacramento Peak Observatory AFCRL, Sunspot, N. M. 88349, U.S.A.). Solar Phys.; 37: No. 2, 351-352(Aug 1974).

The degree of polarization of emission lines resulting from resonance scattering is among others dependent on the details of the atomic transition involved. Maximum polarization occurs for scattering angles of 90°, in the absence of a magnetic field. (auth)

12346 RESONANT SCATTERING OF PARTICLES AND SECOND PHASE ACCELERATION IN THE SOLAR CORONA. Melrose, D. B. (Australian National Univ., Canberra). Solar Phys.; 37: No. 2, 353-365(Aug 1974).

Effective acceleration of particles by hydromagnetic turbulence requires that the particles be scattered at a rate ν comparable with the frequency ω of the turbulence. The only effective scattering process is due to resonant wave–particle interactions. The resonant waves are HM waves for ions with $\beta > \beta_A$ (βc = particle speed, $\beta_A c$ = Alfvén speed) and for electrons with $\gamma\beta \geq 43\beta_0 (\beta_0 \sim 43\ \beta A)$, and are whistlers for electrons with $\beta_0 < \gamma\beta \lesssim 43\beta_0$. The resonant waves can be generated by an anisotropic distribution of particles provided that the anisotropy factor A exceeds a threshold anisotropy $A_0 \sim \beta A/\beta$ for HM waves and $A_0 \sim \beta_0^2/\beta^2\gamma$ for whistlers. Turbulence with relative magnetic amplitude ϵ causes acceleration at a rate $\nu_a \sim \omega\epsilon^2\beta A/\beta$ provided the following conditions are satisfied: (a) $\beta > \beta A$ for ions, $\beta > \beta_0$ for electrons; (b) $\epsilon > A_0$; (c) $nl/ne \lesssim \omega/\Omega i$ or $nl/ne > (\omega/\Omega i)\ (\gamma\beta/43\beta_0)^2$ for scattering by HM waves or whistlers respectively (nl = number density of accelerated particles, Ωi = ion gyrofrequency). The injection energy for electrons ($\beta > \beta_0$) implies that second phase acceleration can be operative for electrons resulting from first phase acceleration (energies ≤ 40 keV) only in regions with Alfven speed $\leq 3 \times 10^3$ km s^{-1} ($\beta A \lesssim 10^{-2}$). Acceleration on a time scale of a few minutes can result from turbulence with typical periods in the range 0.1 s to 10 s, whose presence is indicated by pulsations of meterwave continuum radiation. (auth)

12347 ELECTRONS IN THE SOLAR CORONA. I. Electron Density Models of Streamers at Eclipse 15 February 1961. Dollfus, A.; Laffineur, M.; Mouradian, Z. (Observatoire de Paris, Section de Meudon, 92 (France)). Solar Phys.; 37: No. 2, 367-394(Aug 1974).

During the eclipse of 15 February 1961, photometric measurements were obtained for the inner corona till r/Ro = 2.5 at Imperia, Italy, and for the outer corona between r/Ro = 2.0 and 7.0 at Hvar, Jugoslavia. Morphologic pictures of the streamers were taken at Observatoire de Haute-Provence, France, with the technique of the gradient compensation. K-coronameter observations were daily recorded at Meudon and Pic-du-Midi Observatories, France, from 9 to 22 February 1961. These combined techniques give accurate localization, shape and photometry of the streamers. Four of them lie near the limb-plane and the mathematical approach of Van de Hulst applies to derive the electron-density repartition within these streamers. Compared with the previously published electron-density determinations on 10 corona-streamers, the new determinations correspond to a particularly large variety of streamers. Local increases of electron-densities are found at the neck of helmet-shaped streamers, with an almost local zero gradient and are discussed. (auth)

12348 FINE STRUCTURE OF A VERY BRIGHT ACTIVE REGION AT A WAVELENGTH OF 2.8 CM. Felli, M.; Pampaloni, P.; Tofani, G. (Osservatorio Astrofisico di Arcetri, Florence, Italy). Solar Phys.; 37: No. 2, 395-402(Aug 1974).

The radio structure of the active region McMath 11976 has been investigated with an eastwest resolution of 16″ at a wavelength of 2.8 cm. Six bright components were found with angular sizes of the order of 20″. From the position measure of these components in two following days the heights above the solar photosphere are determined. Their positions are compared with the Hα and magnetic structure of the active region. The derived brightness temperatures reach unusual values, up to 6×10^6K for the brightest component. (auth)

12349 BRIGHTNESS DISTRIBUTION AT λ = 3 AND 21 CM NEAR THE SOLAR NORTH POLE. Drago, F. C.; Patriarchi, P. (Osservatorio Astrofisico di Arcetri, Unita di Ricerca del C.N.R., Firenze, Italy). Solar Phys.; 37: No. 2, 403-408(Aug 1974).

The brightness distribution of the Sun near the north pole at λ = 3 and 21 cm is obtained using the results of the partial eclipse of February 25, 1971. The solution obtained by expanding Bλ(r) in orthogonal polynomials does not show any brightening at either frequency, but a sensible darkening. If this result is explained by the presence of spicules, the coronal emission must be negligible with respect to the emission coming from the transition region. This is possible, at λ = 21 cm, only if we assume the presence of a coronal hole near the pole. (auth)

12350 A MODEL OF A STATIONARY, ISOTHERMAL CORONAL STREAMER. Weber, W. J.; Rosenberg, H. (Astronomical Institute, Utrecht, The Netherlands). Solar Phys.; 37: No. 2, 409-427(Aug 1974).

A quantitative analysis has been made of Pneuman's model for a coronal streamer, resulting from the interaction between a neutral sheet in a plasma with finite conductivity, and the solar wind. Although there are very restrictive assumptions in this model, it seems to describe the expected coronal background structure with enhanced plasma density. Pneuman's analysis is modified and improved where necessary and the method is used to compute a two parameter model. A discussion is made of the method to set the parameters, based on data obtained from Type III radio bursts. The influence of the free parameters on various aspects of the structure is investigated numerically. (auth)

12351 POLARIZATION RESULTS OF SOLAR X-RAYS FROM OSO-7. Nakada, M. P.; Neupert, W. M.; Thomas, R. J. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Solar Phys.; 37: No. 2 429-435(Aug 1974).

Polarization measurements of solar x-ray events that were obtained with an instrument on OSO-7 are presented. The results appear to be consistent with the results of Tindo, et. al. on the existence and magnitudes of polarization. A comparison with polarization predictions when x rays are produced by radial beams of electrons gives two examples of deviations from such a model. (auth)

12352 SHOCK WAVES GENERATED BY THE INTENSE SOLAR FLARE OF 1972, AUGUST 7, 15:00 UT. Maxwell, A.; Rinehart, R. (Harvard Coll. Observatory, Cambridge, Mass. (USA)). Solar Phys.; 37: No. 2, 437-442(Aug 1974).

The dynamic radio spectrum of the class 3B solar flare of 1972, August 7, 15:00 UT, over the band 10 to 2000 MHz is examined. Type II and Type IV bursts in the spectrum are interpreted in terms of a piston-driven shock, which appeared to be travelling at a velocity of about 1500 kms^{-1} and which generated pulsations in the band 100 to 200 MHz as it passed through the corona. The progress of the shock through the interplanetary plasma was subsequently monitored by Malitson, et. al. with radio equipment covering the band 0.03 to 2.6 MHz on the IMP-6 satellite. (auth)

12353 A TYPE II SOLAR RADIO BURST OBSERVED IN THE CORONA AND IN INTERPLANETARY SPACE. Palmer, I. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Solar Phys.; 37: No. 2, 443-449(Aug 1974).

A Type II solar radio burst, which was observed by the satellite IMP-6 and reported by Malitson, et. al. (1973a), is correlated with a Type II burst recorded by ground-based instruments at Culgoora. Since no other important coronal activity (as measured by meter-wave observations) occurred in the 9 hr preceding the onset of the Type II burst at IMP-6, this association is preferred as an alternative to the nonexplosive flare source suggested by Malitson, et. al. A discrepancy is revealed by trying to fit both sets of observations to a typical plasma density profile. The interpretation favored is that an expanding shock wave interacted with two different plasma structures (possibly streamers) which produced the radio emission recorded by the two instruments respectively. In this case it is not meaningful to compare shock speeds deduced at different distances from the Sun, although future observations of this nature may be a useful tool for investigating shock deceleration at distances $\gtrsim$50 solar radii. (auth)

12354 ABUNDANCE DIFFERENCES IN SOLAR WIND DOUBLE STREAMS. Asbridge, J. R.; Bame, S. J.; Feldman, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Solar Phys.; 37: No. 2, 451-467(Aug 1974).

Eight examples of persistent double ion streams with simultaneously resolved protons and alpha particles have been found in the 1971 and 1972 data from the Los Alamos plasma analyzer on IMP 6. The proton streams are observed to have greater velocity separations than their alpha particle counterparts and the secondary stream is the higher velocity stream in each of these examples. Helium to hydrogen abundance ratios for the two streams observed simultaneously differ by up to a factor of ~4; the average is 2.3. The secondary, higher velocity stream usually has the larger fraction of helium. Selection criteria may bias these results to some degree. Observations of double streams at 1 AU with large abundance differences in the separate streams provide evidence that their origin is in a corona with an inhomogeneous distribution of helium, although the evidence may not be considered conclusive at present. Several conceptual models are suggested for the formation of double streams which account for these abundance differences. (auth)

12355 OBSERVATION OF SECTORED STRUCTURE IN THE OUTER SOLAR CORONA: CORRELATION WITH INTERPLANETARY MAGNETIC FIELD. Howard, R. A.; Koomen, M. J. (Naval Research Lab., Washington, D. C. (USA)). Solar Phys.; 37: No. 2, 469-475(Aug 1974).

Daily images of the white light corona between 3 and 10 $R_\odot$ have been recorded by a coronagraph aboard the OSO-7 unmanned satellite since October 3, 1971. Images for the years 1972 and 1973 have been examined for persistent coronal forms. For most of 1972 there passed over the Sun's east limb a regular alternation of northern and southern streamers separated frequently by equatorial fans. The alternation suggested the rotation of a stable four-sectored coronal structure produced by two northern streamers, 180° apart in longitude and a similar pair of southern streamers shifted 90° in longitude. Toward the end of 1972 this structure evolved into a two-sectored structure produced by a single northern streamer and a single southern streamer separated by 180° in longitude. This structure remained stable during most of 1973. Transition from a northern to southern streamer, converted to Earth passage dates, correlated with the passage of a − / + sector boundary in the interplanetary magnetic field. Conversely, the transition from a southern to northern streamer was associated with a + / − boundary passage. These correlations support the recent observations of Hansen, et al. (1973). (auth)

12356 SOLAR RADIO PULSATIONS AT DECAMETRIC WAVELENGTHS. Achong, A. (Dept. of Physics, University of the West Indies, Kingston, Jamaica, W. I.). Solar Phys.; 37: No. 2, 477-482(Aug 1974).

Quasi-periodic solar emission has been observed with a radio spectrograph operating at 18-28 mHz during weak decametric continuum on August 22, 1972. The continuum activity was observed simultaneously on fixed frequency receivers at 18 MHz and at 26 MHz. The pulsations showed a mean period of 4s and a sharp low-frequency cut-off at 24 MHz. Spectral characteristics of these and similar pulsations observed by other workers are examined and shown to be consistent with an interpretation based on an oscillating magnetic flux tube in the solar corona. (auth)

12357 THE COOLING OF A SUNSPOT. V. Reply to M. H. Gokhale. Wilson, P. R. (Sydney Univ. (Australia). Dept. of Applied Mathematics). Solar Phys.; 37: No. 2, 483-486(Aug 1974).

Gokhale (1974) has recently criticized several points in the first two papers in this series. He first emphasizes the inadequacy of the axisymmetric models of magnetic and velocity fields which were used in Paper I, in particular the inability of these models to satisfy the zero divergence conditions. While the author is in complete agreement with Gokhale regarding the limitations of axisymmetric models, it is not agreed that his original statement was misleading except in the sense that he did not specify clearly the local region. The author agrees with Gokhale that the magnetic power is not a likely explanation of the residual energy deficit. (auth)

12358 REPLY TO GILMAN CONCERNING "SOLAR POLAR SPIN DOWN". Schatten, K. H. (Victoria University of Wellington, Wellington, New Zealand). Solar Phys.; 37: No. 2, 487-490(Aug 1974).

In this note Gilman's (1974) arguments are refuted and reasons are given for rejecting the Earth's Rossby waves as a mechanism for driving the solar differential rotation as Gilman (1972) has proposed. (auth)

12359 COMMENTS ON SCHATTEN'S REPLY TO MY COMMENTS ON "SOLAR POLAR SPINDOWN". Gilman, P. A. (National Center for Atmospheric Research, Boulder, Colo. (USA)). Solar Phys.; 37: No. 2, 491-492(Aug 1974).

The author reiterates his earlier criticisms of Schatten (1973) made in Gilman (1974). For Schatten's (1973) theory of differential rotation to hold requires that turbulent mixing in the solar convection zone be many orders of magnitude less than is reasonable. (auth)

12360 ON THE SOLAR MAGNETIC "MONOPOLE". Stix, M.; Wiehr, E. (Goettingen Univ. (F. R. Germany)). Solar Phys.; 37: No. 2, 493-495(Aug 1974).

A superposed epoch analysis shows that the Sun's spurious magnetic monopole varies like the solar declination. This indicates that the monopole is caused by instrumental effects. (auth)

Galaxies

Refer also to abstract 12294.

12361 (AD-779372) HIGH RESOLUTION NEUTRAL HYDROGEN STUDY OF GALAXY M81. Weliachew, L.; Gottesman, S. T. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 69p. NTIS $3.75.

Observations of the galaxy M81 (NGC 3031) were made using the two element interferometer of the Owens Valley Radio Observatory. Operating at the appropriate Doppler-shifted neutral hydrogen frequency a resolution of 2 arc min is synthesized which is equivalent to 1.9 kpc at a distance of 3.25 mpc. (auth)

12362 MEASUREMENTS OF DIAMETERS OF GALAXIES ON THE PALOMAR OBSERVATORY SKY SURVEY. Kalinkov, M.; Stavrev, K.; Karadzov, D.; Mihnevski, N. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 97-147(1972).

The inner and outer diameters of the galaxies up to 15.7m were measured on copies 1398 and 64 of the Palomar survey. The regressions between M_{2w} and B(0), the links between the measured mean diameters and B(0) the confidence intervals for the mean diameters measured, and the star values after Zwiki were determined. The representativeness of the outer diameters and the sphericity of the galaxies were established by the method of multidimensional statistical analysis. The need for logarithmic transformation of the diameters in the regressions with stellar values was established. It was demonstrated that an effective counting of the galaxies in the Palomar survey may be carried out to 20.7m to 21.0m and an effective measuring of their diameters up to 19.0m to 19.5m, and that for each copy of the regressions and the confidence intervals, reliable estimates of the stellar values may be made on the basis of the visible mean diameters of the galaxies. (tr-auth)

12363 SURFACE DISTRIBUTION OF INTERACTING AND NORMAL GALAXIES ROUND THE NORTH GALACTIC POLE. Kalinkov, M.; Spasova, N. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 149-164(1972). (In Russian).

A statistical study was made of the visible surface distribution of normal galaxies (according to the catalog of Zwiki for $m \geq 15.7$m and interacting systems of galaxies after Vorontsov-Velyaminov in 13 fields of the Palomar atlas. It was found that the distribution of the interacting galaxies is accidental. Association was established for the normal galaxies in the intervals 12.1m to 13.0m and 13.1m to 14.0m. Segregation does not exist in interacting systems with probability $D > 0.99$. One of the most important conclusions is that the surface distribution of the noraml galaxies and the interacting systems round the north galactic pole is accidental. (tr-auth)

12364 FLOW PROBLEMS IN ASTROPHYSICAL SYSTEMS. Cranfill, C. W. San Diego, CA; Univ. of California (1974). 182p. University Microfilms Order No. 74-23,961.

Thesis (Ph. D.).

Several flow problems encountered in astrophysical systems are studied with emphasis placed on idealized analytic solutions. The three general areas covered are the reconnection of magnetic fields, the properties of stellar winds, and the expansion of HII regions. (WDM)

12365 STARS AND THE MILKY WAY SYSTEM. Volume 2. Proceedings of the First European Astronomical Meeting, Athens, Greece, September 4−9, 1972. Mavridis, L. N. (ed.). Berlin; Springer−Verlag (1974). 379p. $56.30.

The papers deal with variable and binary stars, space distribution and motions of stars, interstellar matter, the galactic center, chemical evolution of the Galaxy, infrared astronomy, instruments, the three-body problem, and galactic dynamics. Variable stars and stellar evolution, Gould's belt, molecules as probes of the interstellar matter, ionized gas in the direction of the galactic center, diffusion of elements in the Galaxy, and the interpretation of far infrared observations are treated. Attention is given to the high-speed evaluation of photographic plates, periodic orbits of the restricted problem for various values of the mass ratio, and galactic models and stellar orbits. (IAA)

12366 LOW−DENSITY IONIZED INTERSTELLAR GAS AS REVEALED BY INTERSTELLAR OPTICAL AND H I RADIO LINES. Heiles, C. (Astronomy Department, University of California, Berkeley). Astrophys. J. Lett. 193: No. 1, L31-L33 (1 Oct 1974).

Stars showing nonzero velocity optical interstellar lines usually have no corresponding H I radio line, but there often exists an H I cloud at the same velocity 5°−10° away in the sky. We suggest that in many cases the radio line is unobservable at the position of the star because the gas is ionized. This ionization might be caused by a global source of ionization rather than a more localized one such as the star itself because there may be a tendency for such stars to exist almost exclusively at negative Galactic latitudes. Existing spectra of extragalactic objects should, in some cases, have sufficient velocity resolution to apply to these problems. (auth)

12367 INTERSTELLAR ABUNDANCES TOWARD ZETA OPHIUCHI. Morton, D.C. (Princeton University Observatory). Astrophys. J. Lett. 193: No. 1, L35-L39 (1 Oct 1974).

Extensive Copernicus observations of interstellar absorption lines in front of ζ Oph have been combined with similar ground-based data to give column densities or limits on 26 elements in H I clouds. Compared with solar-system abundances, there is a depletion of most elements relative to hydrogen, except S and Zn, by factors of 3 to 4000. The depeletions generally are larger for the higher condensation temperatures. (auth)

12368 KINEMATICS OF THE ORION A MOLECULAR CLOUD. Linke, R.A. (Bell Laboratories, Crawford Hill Laboratory, Holmdel, New Jersey); Wannier, P.G. Astrophys. J. Lett. 193: No. 1, L41-L44 (1 Oct 1974).

We examine the velocity structure of J=1 to J=0 emission of CO in the Orion A molecular cloud and present extended strip maps in both declination and right ascension intersecting at the position of peak intensity. The results in declination show evidence for range-scale rotation while the right ascension maps show features which can be interpreted as gravitational condensations. The observed rotation is found to be sufficient to support a density equal to that estimated for the cloud ($N_{H_2} \sim 2 \times 10^3$ cm^{-3}). (auth)

12369 INFRARED OBSERVATIONS OF H II REGIONS IN EXTERNAL GALAXIES. Strom, S.E.; Strom, K.M.; Grasdalen, G.L. (Kitt Peak National Observatory); Capps, R.W. Astrophys. J. Lett. 193: No. 1, L7-L10 (1 Oct 1974).

Measurements of 14 extragalactic H II regions at 10 and 20 μ are reported. With the possible exception of IC 131 in M33, none of these regions was detected. In some cases, upper limits are a factor of at least 10 below those predicted from the observed centimeter radio flux, S_{cm}, and the empirical relation between S_{cm} and 10-μ flux for H II regions in our own Galaxy. Possible explanations for this discrepancy are discussed. (auth)

12370 CHEMICAL HEATING OF INTERSTELLAR CLOUDS. Dalgarno, A.; Oppenheimer, M. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. 192: No. 3, 597-599 (15 Sept 1974).

The formation and destruction of molecules provides a mechanism for extracting energy from the interstellar radiation field and converting it into thermal energy. The chemical heating sources arising from chemical cycles involving CH_2^+ and OH are estimated. The CH_2^+ cycle is a larger source than the H_2 formation and destruction source in regions where the hydrogen is largely molecular. The OH cycle may enhance the cosmic-ray heating rate by a factor of about 3, depending upon the rate coefficients of the various reactions. (auth)

12371 THE SATURATION BEHAVIOR OF NONUNIFORMLY PUMPED MASERS. Keeley, D.A. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 192: No. 3, 601-606 (15 Sept 1974).

Herbig has recently suggested that the OH maser clouds associated with NML Cygnus are radiating the 1612-MHz line mostly in the hemisphere facing away from the star. Such an anisotropy, if real, might be the result of inhomogeneous pumping such as would be provided by the stellar radiation. In this paper, the behavior of a simple one-dimensional inhomogeneously pumped model is examined for an arbitrary degree of saturation. This model has been chosen because it allows an almost complete analytic treatment, rather than for any close correspondence with reality. Thus its real purpose is to provide some insight into the general problem of nonuniform pumping by providing a relatively simple means of investigating the entire range of saturation. (auth)

12372 THE NATURE AND DISTRIBUTION OF CARBON RECOMBINATION-LINE EMISSION IN THE RHO OPHIUCHI DARK CLOUD. Brown, R.L.; Gammon, R.H. (National Radio Astronomy Observatory, Green Bank, West Virginia); Knapp, G.R.; Balick, B. Astrophys. J. 192: No. 3, 607-614 (15 Sept 1974).

Observations of the C 167α line at two positions and of the C 110α line at six positions in the ρ Oph dark cloud show the recombination-line emission to be detectable in a region ~1° in extent. The high-frequency observations suggest that individual emission regions have angular sizes <6′. From a comparison of the C 167α line with the C 110α line we conclude that the electron density is ~1 cm^{-3} and the temperature T ≤ 20°K in the recombination-line regions. We suggest that the most reasonable interpretation of these results is that the lines arise in compact C II regions surrounding B-type stars embedded in the dark cloud. It is likely that these are the same stars that have recently been detected as near-infrared point sources. The detection of 350-μ radiation from these same regions reinforces this interpretation. (auth)

12373 AN ATLAS OF SEYFERT GALAXIES. Khachikian, E.Y. (Byurakan Astrophysical Observatory, Armenia, USSR); Weedman, D.W. Astrophys. J. 192: No. 3, 581-589 (15 Sept 1974).

Data now available for 71 Seyfert galaxies are summarized and discussed. A collection of 37 spectra is presented to illustrate the spectral characteristics of these galaxies, and new UBV data are included for 18 galaxies. A well-defined angular-diameter-redshift relation is found to exist for the total sample of galaxies, so it is concluded that the redshifts are cosmological. The mean M_u for 40 Seyfert nuclei whose properties resemble the QSOs is calculated to be -20.4, with 21 nuclei having $-20 > M_u > -21.5$. (auth)

12374 OBSERVATION OF THE $3_{12}-3_{13}$ TRANSITION OF INTERSTELLAR FORMALDEHYDE. McCutcheon, W. H.; Shuter, W. L. H. (Univ. of British Columbia, Vancouver). Nature (London); 251: No. 5471, 123-124(13 Sep 1974).

Emission from the $3_{12}-3_{13}$ transition at 28.975 GHz in Sagittarius A is reported. The observations were made with the 4.57m Cassegrain paraboloid at the University of British Columbia. Spectral data were obtained with a filter spectrometer. (UK)

12375 DOES THE GALAXY POSSESS A GASEOUS HALO? Silk, J. (Univ. of California, Berkeley). Comments Astrophys. Space Phys.; 6: No. 1, 1-6(1974).

The possible existence of a gaseous galactic halo is of considerable importance in such matters as ascertaining the equilibrium of gas in the galactic disk and spiral arms, and the degree of confinement of cosmic rays in the galaxy. Extended gaseous haloes in intervening galaxies can provide a source of interstellar uv absorption lines that may be detectable in the spectra of quasars. Hence it seems a useful exercise to summarize the observational data that suggest the presence of a halo around the galaxy, and the halo parameters thereby inferred. (WDM)

12376 PHOTOGRAPHIC PHOTOMETRY OF COMPACT GALAXIES NEAR THE NORTH GALACTIC POLE. Notni, P. (Deutsche Akademie der Wissenschaften, Babelsberg, Ger.). Astron. Nachr.; 295: No. 1, 33-45(1974).

Photoelectric standards in M3 provided by Sandage (1970) were employed to establish the scale in U and B. A table with data for B, B-r, and U-B is presented for 265 galaxies. Corrections to total magnitudes are discussed along with systematic deviations of colors. The great majority of compact, spherically concentrated galaxies occupies a region in the two-color diagram. Information regarding standard stars and the color system is provided in an appendix. It is pointed out that three objects, including III 95, III 106, and III 182, show high ultraviolet and blue excesses. It appears nearly certain that these objects belong to the category of the active blue galaxies. (IAA)

12377 SMALL STRUCTURES IN GALACTIC AND EXTRAGALACTIC NEBULAE. Meurers, J. (Univ. Sternwarte, Vienna). Astron. Nachr.; 295: No. 3, 151-157(1974).

The boundaries of nebulae are often characterized by irregularities in form of bays and projecting parts. Approaches for measuring the sizes of these irregularities are considered, taking into account the method of equidensitometry. A table showing the sizes of irregularities in the border of the North America Nebula is presented. Investigations regarding the arms of galaxies are discussed along with studies involving artificial galaxies. Questions concerning an application of the equidensity method for the marking of objects are also explored. (IAA)

12378 EXTINCTION FEATURE AT LAMBDA 2200 A AND THE DIFFUSE INTERSTELLAR LINES. Dorschner, J. (Univ. Sternwart, Jena, Ger.). Astron. Nachr.; 295: No. 3, 147-149 (1974).

12379 ON THE LUMINOSITY FUNCTION OF RADIOGALAXIES. Soltan, A. (Polska Akademia Nauk, Warsaw. Zaklad Astronomii). Acta Astron.; 22: 261-265(1972).

The luminosity function of radiogalaxies is determined over the range of radio power at frequency 178 MHz $22 < \log P_{178} < 26$, where P_{178} is in W Hz^{-1} ster^{-1}, based on the complete sample of radiogalaxies identified with objects from 3C catalog down to limiting visual magnitude $m_v = 15$. Since the redshifts of all objects in the sample are known, the luminosity function is evaluated without any additional assumptions about distances of galaxies. The results are in satisfactory agreement with previous investigations based on more numerous samples of objects with indirectly determined distances. (auth)

12380 INDICATIONS OF INTERGALACTIC EXTINCTION EFFECT CONNECTED WITH LARGEST CLUSTERS OF GALAXIES. Toborek, I. (Uniwersytet Jagiellonski, Krakow (Poland), Obserwatorium Astronomiczne). Acta Astron.; 22: 67-71(1972).

The continuation and conclusion of the papers by Rudnicki (1963) and Brukalska (1969) are given. The numbers of very distant clusters situated in fields of Zwicky's catalog containing largest clusters of various types and distance classes are considered. On the whole, the results can be interpreted in favor of the relation between largest clusters of galaxies and intergalactic extinction. (auth)

12381 THE ETHYNYL RADICAL C_2H—A NEW INTERSTELLAR MOLECULE. Tucker, K.D. (Goddard Institute for Space Studies, New York); Kutner, M.L.; Thaddeus, P. Astrophys. J. Lett. 193: No. 3, L115-L119 (1 Nov 1974).

Four new interstellar lines have been detected in a number of galactic sources with derived rest frequencies of 87,317.05, 87,328.70, 87,402.10, and 87,407.23 MHz. Based on laboratory ESR data in solid state, these lines have been positively identified as hyperfine components of the N=1—0 transition of the ethynyl radical C_2H. The astronomical observations yield precise values for the C_2H rotation, spin—doubling, and hyperfine constants, namely, $2B_0=4D_0=87,348.74\pm0.19$ MHz, $\gamma=-62.57\pm0.13$ MHz, $b=40.24\pm0.43$ MHz, and $c=12.23\pm0.35$ MHz. Ethynyl is apparently one of the most abundant interstellar polyatomic molecules with column densities in the best sources $\sim10^{15}$ cm^{-2}. In the Orion Nebula the north—south extent of C_2H emission is nearly a quarter of a degree. (auth)

12382 A SURVEY WITH COPERNICUS OF INTERSTELLAR O VI ABSORPTION. Jenkins, E.B.; Meloy, D.A. (Princeton University Observatory). Astrophys. J. Lett. 193: No. 3, L121-L125 (1 Nov 1974).

Ultraviolet spectra recorded by the Copernicus satellite for 32 stars reveal the widespread presence of broad, shallow absorptions caused by O VI ions. The lack of an apparent correspondence between the radial velocities of the stars and those of the O VI profiles seems to argue in favor of an interstellar, rather than circumstellar, origin. The data suggest the presence of a low—density, high—temperature phase of the interstellar gas. This phase is possibly produced by supernova explosions. Absorption—line widths suggest upper limits for log T ranging from about 5.4 to 6.3, and an overall average of 1.7×10^{-8} O VI ions cm^{-3} was recorded over the various lines of sight. For log T=6.0 the gas could occupy a significant fraction of interstellar space and be in pressure equilibrium with the normal H I gas. As suggested by Kraushaar, this hot gas may be responsible for the soft X—ray background flux. (auth)

12383 HIGHLY IONIZED ATOMS OBSERVED WITH COPERNICUS. York, D.G. (Princeton University Observatory). Astrophys. J. Lett. 193: No. 3, L127-L131 (1 Nov 1974).

Equivalent width measures for lines of the O VI resonance doublet, and upper limits for the resonance lines of N V, Si IV, and Si V, are reported in five stars, based on high—resolution observations using the Princeton satellite/spectrometer on Copernicus. Using the ratio N(S IV)/N(O VI), a lower limit to the temperature in the O VI—producing region is derived, while the observed line widths yield an upper limit. For the observed region, 2×10^{5}°K $<T<2\times10^{5}$°K for five stars, if the inferred plasma is not circumstellar. The minimum densities are consistent with a hot plasma in near pressure equilibrium with normal interstellar clouds and H II regions. (auth)

12384 20 TO 40 MICRON SPECTROSCOPY OF THE ORION NEBULA. Houck, J.R.; Schaack, D.F.; Reed, R.A. (Center for Radiophysics and Space Research, Cornell University). Astrophys. J. Lett. 193: No. 3, L139-L141 (1 Nov 1974).

We present moderate—resolution (1.0 μ) spectra of the Orion Nebula. These observations are the first spectroscopic observations of the object between 20 and 40 μ. A comparison of our data with that of Harper, Soifer and Hudson, and Harvey et al. is presented. We find that the best—fit to all of the data is provided by a model in which the dust within the molecular cloud has a clumpy distribution. The individual clumps have effective grain temperatures of 100°K and are optically thick for wavelengths shorter than 400 μ. The total dust mass required by this model is less than 20 $M_\odot$. (auth)

Cosmology

Refer also to abstracts 13071 and 13117.

12385 HAS GAMOV'S COSMOLOGIC HYPOTHESES BEEN CONFIRMED. Polikarov, A. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 89-95(1972).

The groundlessness, both in a philosophical-logical and an empirical aspect, of the view (J. Zeldović), that the cosmic phonic (relict) radio emission is a proof of Gamov's cosmologic model is demonstrated. The most essential observation facts lend themselves to variant interpretation in the different concurrent cosmologic models and in particular in given modifications of the conception of a stationary universe. (tr-auth)

12386 FROM STONEHENGE TO MODERN COSMOLOGY. Hoyle, F. San Francisco; W. H. Freeman and Company (1972). 101p. $4.95.

A series of four lectures is contained in this volume; two on cosmology, one on Stonehenge, and one on science and society in modern times. (WDM)

12387 THE SIZE AND MASS OF GALAXIES, AND THE MASS OF THE UNIVERSE. Ostriker, J.P. (Princeton University Observatory); Peebles, P.J.E.; Yahil, A. Astrophys. J. Lett. 193: No. 1, L1-L4 (1 Oct 1974).

Currently available observations strongly indicate that the mass of spiral galaxies increases almost linearly with radius to nearly 1Mpc. This means that the total mass per giant spiral is of the order of 10^{12} $M_\odot$, and the ratio of this mass to the photographic light within the Holberg radius, f, is $\sim 200\ (M/L)_\odot$. Using the value of f and the luminosity function of surveyed galaxies, we determine a local mean cosmological mass density $\simeq2\times10^{-30}$ g cm^{-3} corresponding to $\Omega\equiv\rho/\rho_{crit}\simeq0.2$. The uncertainty in this result is not less than a factor of 3. (auth)

12388 COSMOLOGICAL PARAMETERS FOR A RESTRICTED CLASS OF CLOSED BIG—BANG UNIVERSES. Landsberg, P.T. (Department of Mathematics, The University, Southampton, England); Pathria, R.K. Astrophys. J. 192: No. 3, 577-579 (15 Sept 1974).

The half—plane defined by the deceleration parameter q and the density parameter σ is reexamined to locate the regions appropriate to a closed big—bang universe which cannot expand without limit. Algebraic and numerical inequalities, relevant to these regions, are established for the cosmological constant, the radius of curvature of the 3—space, and the age of the Universe. The permitted values of the various parameters lie within reasonably narrow limits. (auth)

12389 COSMIC MAGNETOHYDRODYNAMICS. Moss, D. L. (Univ. of Manchester, Eng.). Phys. Bull. (London); 24: 668-670(Nov 1973).

MHD phenomena have important roles to play in many astrophysical problems. It is shown that a mechanism has to be sought to maintain the terrestrial field against ohmic decay and to account for the observed solar and terrestrial field polarity reversals. The bulk of the Earth's core is believed to be a conducting fluid, and so there is the possibility of the field being regenerated by the fluid motions. The feasibility of the operation of such a MHD dynamo is considered. There seems little doubt that a dynamo operates in the Sun. However in stars of a few solar masses (Ap stars) which exhibit very strong surface magnetic fields there may be a different situation. The oblique rotator theory is considered with respect to the peculiarities exhibited by these stars. Turning to the origin of galactic fields, two main theories, dynamo and primordial, are discussed. The problem of pulsars introduces relativistic effects and displacement current which are considered. MHD problems associated with the radiation emission mechanism are outlined. It is concluded that although MHD phenomena are recognized as playing a major role in many astrophysical problems, few have yet been completely solved. (UK)

12390 RECENT DEVELOPMENTS IN COSMOLOGY. Rees, M. J. (Cambridge Univ., Eng.). Phys. Bull. (London); 24: 651-653(Nov 1973).

The great significance of the detection by Penzias and Wilson in 1965 of the cosmic microwave background radiation is discussed. Since then there have been many different measurements, referring to different frequencies, of the spectrum of this radiation and all are consistent with a blackbody spectrum at a temperature of approximately 2.7°K. The measurements referring to the Rayleigh—Jeans part of the spectrum have been mostly made from the ground. Indirect evidence on the spectrum at millimetric wavelengths comes from observations of interstellar molecules, and some direct measurements have been attempted from rockets and balloons. The millimeter spectrum—crucial though it is for many theoretical considerations—is still much more uncertain than that of longer wavelengths. The other remarkable property of the microwave background is its isotropy. The mounting evidence for the thermal spectrum of the microwave background, together with the apparent absence of any small scale "graininess" in its angular distribution, renders any theories attributing it to discrete sources at recent epochs exceedingly contrived and ad hoc, and thereby strengthens the case that it is indeed primordial radiation. Most cosmologists have therefore adopted the so called "hot big-bang theory" as a basis for interpreting observations and for theoretical calculations. This model implies that the material in the early Universe would constitute a hot plasma, strongly coupled to a radiation field. The existence of galaxies, clusters of galaxies and perhaps superclusters implies that the Universe is not completely homogeneous. However, the extraordinarily precise overall isotropy is a key property of the Universe and various theories are considered. The classical cosmological problems of determining observationally the Hubble constant and the so called "deceleration parameter" are discussed. (UK)

12391 GRAVITATIONAL COLLAPSE AND BLACK HOLES. Taylor, J. (King's Coll., London). Phys. Bull. (London); 24: 654-656(Nov 1973).

The complexities of the processes occurring during the collapse of a heavy star are considered. It has proved difficult to find out whether the excess matter in a star, above the limit allowing it to become a white dwarf or neutron star, can be lost sometime during stellar evolution by radiation of various forms (especially of neutrons), or by spinning off due to increased rotation as the collapsing stage ensues, or by being blown off directly by the released radiation. A black hole arises when a heavy star has collapsed to such an extent that its mass M has been compressed to a region smaller than its Schwarzschild radius $2GM/c^2$, for then there is an infinite redshift for light at that distance from the center of the collapsing object. No light can then escape to an observer outside this Schwarzschild distance. The question of firm evidence of the existence of black holes is discussed and possible candidates are considered. The issue of the final state of matter in collapse is discussed. It is considered that the problem is of the utmost importance to the whole of physics. (UK)

12392 GRAVITATIONAL RADIATION AND GENERAL RELATIVITY. Sciama, D. W. (Oxford Univ.). Phys. Bull. (London); 24: 657-659(Nov 1973).

The prospect of detecting gravitational waves and the sensitivity of instruments which would be required are considered. The main properties of propagating gravitational waves, as predicted by general relativity, are compared with those of electromagnetic waves. It is shown that gravitation, the weakest of all the known interactions in nature, can manifest itself in a form in which more of the rest mass energy of matter can be released than through any other known process, except matter–antimatter annihilation itself. In view of the likely prevalence of collapsed objects in the Universe, it would be surprising if nature had not taken advantage of this possibility, perhaps on a grand and dramatic scale. (UK)

12393 WORM'S-EYE VIEW OF THE MASS DENSITY IN THE UNIVERSE. Gunn, J. E. (California Inst. of Tech., Pasadena). Comments Astrophys. Space Phys.; 6: No. 1, 7-14(1974).

Attempts to derive the mean mass density in the Universe can be divided roughly into two classes—the "local" techniques and the "global" ones. The latter are exemplified by the classical cosmological tests. The "local" techniques make use of local luminosity density and mass-to-light ratio arguments, or dynamical arguments. This comment is devoted to what might be called a "superlocal" determination; it depends mostly on the Local Group, and assembles ideas which have been around for some time. (WDM)

12394 NUCLEOGENESIS, THE AGE OF THE UNIVERSE AND YOUNG GALAXIES. Pikel'ner, S. B. (Astronomical Inst., Moscow). Comments Astrophys. Space Phys.; 6: No. 1, 15-21 (1974).

Recent determination of the age of the radioactive elements formed when the Galaxy was young allows a reconsideration of the problems of the age of the Universe, the Hubble constant, and the visibility of young galaxies. (WDM)

12395 COSMOLOGICAL PRINCIPLES. I. Symmetry Principles. Ellis, G. F. R. (Cambridge Univ., Eng.); Harrison, E. R. Comments Astrophys. Space Phys.; 6: No. 1, 23-27(1974).

In this discussion some ideas of current interest in cosmology are examined. Symmetry principles are considered, mainly from an observer's point of view. Roughly speaking, the symmetry principles provide a descriptive framework in which the physical principles provide the explanations. (WDM)

12396 FLUCTUATIONS IN THE COSMIC MICROWAVE BACKGROUND ARISING FROM LOW-FREQUENCY GRAVITATIONAL RADIATION. Dautcourt, G. (Deutsche Akademie der Wissenschafte, Babelsberg, Ger.). Astron. Nachr.; 295: No. 3, 123-131(1974).

It is shown that the sensitivity of a microwave receiver device for the detection of low-frequency gravitational radiation depends strongly on the density of matter in the Universe if a primordial origin of the background radiation is assumed. It is pointed out that intense intergalactic gravitational radiation reaching the critical cosmological energy density level is apparently not excluded by the microwave anisotropy data if the density of matter in the Universe is sufficiently high. Attention is given to theoretical expressions for the temperature fluctuations, small-scale fluctuations, large-scale fluctuations, and observed temperature fluctuations for an antenna with Gaussian reception pattern. (IAA)

12397 PRINCIPLE OF CORRESPONDENCE IN COSMOLOGY. II. Classical and Relativistic Representations of Models of the Universe. Treder, H. J. (Deutsche Akademie der Wissenschaften, Babelsberg, Ger.). Astron. Nachr.; 295: No. 2, 55-71(1974). (In German).

Relations concerning the special-relativistic cosmos are considered along with questions regarding Eddington numbers and the absolute size of the Universe. The generation of rest mass in a planar Universe is discussed, giving attention to difficulties in the interpretation of Jordan's (1952) theory of gravitation. The Mach principle and its mathematical formulation, the Mach–Einstein doctrine, contain far-reaching consequences. A linear expanding Mach-Einstein Universe with certain characteristics corresponds to an elementary interpretation of the Mach principle. Questions concerning the equations of motion and the cosmological singularity are also explored, taking into account approaches for avoiding the cosmological singularity. (IAA)

12398 DYNAMO THEORY OF COSMIC MAGNETIC FIELDS. II. Representation of Vector Fields as Sum of a Poloidal and a Toroidal Part. Raedler, K. H. (Zentralinstitut fuer Astrophysik, Potsdam, Ger.). Astron. Nachr.; 295: No. 2, 73-84(1974). (In German).

This paper deals with mathematical fundamentals of the foregoing one on the treatment of spherical dynamo models. A representation of arbitrary vector fields in the three-dimensional euclidean space as a sum of a poloidal and a toroidal part is founded. In this way well-known representations of axisymmetric or not necessarily axisymmetric but solenoidal fields are generalized. The mentioned parts of a field show some remarkable properties allowing far-reaching consequences in special problems. As an example equations governing a class of force-free magnetic fields are solved. Then possibilities of further generalization are investigated. (auth)

12399 ACOUSTICAL HETERODYNE DETECTOR OF GRAVITATIONAL RADIATION. Lyamov, V. E.; Rudenko, V. N. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1585-1593(Nov 1974). (In Russian).

A variant of a heterodyne receiver of gravitational radiation is proposed which is based on the interaction between surface waves and deformations induced by the gravitational wave in a nonlinear medium. The receiver operates in the frequency range $\Omega \sim 10^4$ to 10^6 rad/sec and may be by 4 to 5 orders of magnitude more sensitive than detectors of the Weber type. The changes in structure of the surface wave are calculated and the feasibility of an experimental test is discussed. Estimates are presented of gravitational radiation fluxes which may be detectable. (auth)

12400 GRAVITATIONAL WAVES RETAINING THE HOMOGENEITY OF SPACE. Lukash, V. N. (Moscow Physical-Technical Inst.). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1594-1608(Nov 1974). (In Russian).

A physical interpretation of cosmological VII type models with homogeneous comoving space as gravitational waves with circular polarization (with an arbitrary wavelength λ) in flat space (for VII_0) and in negative curvature space (for VII_h) is proposed. The VII_0 type models describe standing gravitational waves in homogeneous comoving space. The VII_h type models describe traveling gravitational waves. The VII_h type-models with a single traveling wave are integrated and have an exact solution. (auth)

12401 EVOLUTION OF COSMOLOGICAL TURBULENCE. II. DISSIPATION OF SUBSONIC MOTIONS AND ALTERNATIVE MODES OF POST–RECOMBINATION EVOLUTION. Kurskov, A.A.; Ozernoi, L.M. (Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. Astron.–AJ 18: No. 3, 300-306 (Nov 1974).

Analysis is given of the dissipation of cosmological turbulence and the resultant distortions in the primordial–radiation spectrum prior to the onset of plasma recombination at a red shift $z_{rec} \simeq 1.4 \cdot 10^3$. The absence of appreciable departures from a Planck spectrum there sets considerably more accurate limits than previously on the amplitude v_0 of the initial vortex velocity for motions on the maximum scale. However, the remaining uncertainty in v_0 prevents a reliable decision of whether the ratio of the maximum damped turbulence scale R_d to the scale $\hat{R}$ of hydrodynamically "frozen" motions in the absence of dissipation is less or greater than unity at the epoch t_{rec+0} when recombination is completed. If $(R_d/\hat{R})t_{rec+0} \ll 1$, there will be a range of scales $R_d < R < \hat{R}$ on which the motions are not frozen by t_{rec}. Cosmological turbulence on scales $R < \hat{R}$ then could in principle evolve at times $t \geq t_{rec}$ in a "rough" mode, generating shock waves and substantial density irregularities. But if the ratio $(R_d/\hat{R})t_{rec+0} > 1$, post–recombination turbulence will evolve in a "calm" mode, wherein hydrodynamic effects can become significant only after the gravitational growth of irregularities that have been isolated from the background and have formed bound systems. (auth)

Planetary Phenomena

Refer also to abstracts 12336, 12445, 12943, and 13095.

12402 PROISKHOZHDENIE I KHIMICHESKAIA EVOLIUTSIIA ZEMLI. (Origin and Chemical Evolution of the Earth). Voitkevich, G. V. Moscow; Izdatel'stvo Nauka (1973). 168p.

The present work discusses in general terms some of the main questions concerning the origin of the Earth and its chemical changes in the course of its long geological history. Recent cosmochemical, geochemical, and geophysical data are drawn upon to support various hypotheses. The main features of theories of stellar nucleosynthesis are described as well. The nature and chemical composition of the planets is discussed along with theories on the evolution of protoplanetary matter. Main emphasis is on the formation of the various layers of the Earth, the origin and evolution of the oceans and atmosphere, and the chemical evolution of the Earth's core. (IAA)

12403 CHARGED-PARTICLE FLUXES IN THE VICINITY OF MARS. Vernov, S. N.; Tverskoi, B. A.; Yakovlev, V. A. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 228-237(1974).

Translated from Kosm. Issled.; 12: No. 2, 252-263(1974).

This paper presents and discusses the first cosmic-ray flux data taken in orbit around Mars by the Mars 2 spacecraft. The cosmic-ray measurements near Mars were taken from December 14, 1971 to June 1, 1972. Eleven orbits around Mars were followed with a basic time resolution of 10 to 40 min, and additionally individual episodes were studied near the pericenter, at heights from the planet surface ranging from ~1 to ~10 thousands of kilometers, including some with a resolution of 4 min. The measurements were made against the background of the varying solar cosmic-ray flux. (WDM)

12404 U-Th-Pb AND Rb-Sr SYSTEMATICS OF APOLLO 17 BOULDER 7 FROM THE NORTH MASSIF OF THE TAURUS-LITTROW VALLEY. Nunes, P. D.; Tatsumoto, M.; Unruh, D. M. (Geological Survey, Denver, Colo. (USA)). Earth Planet. Sci. Lett.; 23: No. 3, 445-452(Oct 1974).

Portions of highland breccia boulder 7 collected during the Apollo 17 mission were studied using U-Th-Pb and Rb-Sr systematics. A Rb-Sr internal isochron age of 3.89 ± 0.08 b.y. with an initial $^{87}Sr/^{86}Sr$ of 0.69926 ± 0.00008 was obtained for clast 1 (77135,57) (a troctolitic microbreccia). A troctolitic portion of microbreccia clast 77215,37 yielded a U-Pb internal isochron of 3.8 ± 0.2 b.y. and an initial $^{208}Pb/^{207}Pb$ of 0.69. These internal isochron ages are interpreted as reflecting metamorphic events, probably related to impacts, which reset Rb-Sr and U-Pb mineral systems of older rocks. Six portions of boulder 7 were analyzed for U, Th, and Pb as whole rocks. Two chemical groups appear to be defined by the U, Th, and Pb concentration data. Chemical group A is characterized by U, Th and Pb concentrations and $^{238}U/^{204}Pb$ values which are higher than those of group B. Group A rocks have typical $^{232}Th/^{238}U$ ratios of ~3.85, whereas group B rocks have unusually high Th/U values of ~4.1. Whole-rock U-Pb and Pb-Pb ages are nearly concordant. Two events appear to be reflected in these data – one at ~4.4 b.y. and one at ~4.5 b.y. The chemical groupings show no correlation with documented ages. The old ages of ~4.4 b.y. and ~4.5 b.y. may, like the younger ~4.0 b.y. ages, be related to basin excavation events. (auth)

12405 ^{39}Ar-^{40}Ar AGES OF SAMPLES FROM THE APOLLO 17 STATION 7 BOULDER AND IMPLICATIONS FOR ITS FORMATION. Stettler, A.; Eberhardt, P.; Geiss, J.; Groegler, N. (Bern Univ. (Switzerland). Physikalisches Inst.). Earth Planet. Sci. Lett.; 23: No. 3, 453-461(Oct 1974).

^{39}Ar-^{40}Ar ages and ^{37}Ar-^{38}Ar exposure ages of samples representing four different lithologies of the Apollo 17 station 7 boulder were measured. The age of the dark veinlet material 77015 of 3.98 ± 0.04 AE is interpreted as representing the time of intrusion of this veinlet into the 77215 clast. The data obtained so far indicate that the vesicular basalt 77135 formed 100-200 m.y. later. However, this has to be confirmed by ^{39}Ar-^{40}Ar investigations on separated mineral and/or grain-size fractions. A small clast enclosed in the 77135 basalt gives a well-defined high temperature age of 3.99 ± 0.02 AE. A sample of the noritic clast 77215 gave 4.04 ± 0.03 AE, the highest age found so far in this boulder. The ^{39}Ar-^{40}Ar ages obtained are in agreement with the age relationships deduced from the stratigraphic evidence. Taking into account the shielding by the boulder itself, an average ^{37}Ar-^{38}Ar exposure age of (27.5 ± 2.5) m.y. is obtained for the samples collected from the boulder. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 12303, 12304, 12452, and 12453.

12406 (AD-779548) INTENSITY VARIATIONS PRODUCED BY THE ARECIBO IONOSPHERIC MODIFICATION EXPERIMENTS. Sipler, D. P.; Enemark, E.; Biondi, M. A. (Pittsburgh Univ., Pa. (USA). Space Research Coordination Center). May 1974. Contract DAHC04-73-C-0037. 26p. (SRRC-203; APP-46). NTIS $3.25.

Nightglow 6300A intensity suppression and enhancement transients were observed in conjunction with heating of the F region ionospheric electrons in arecibo ionospheric modification experiments (I.M.E.). Ohmic heating of the electrons during x-mode propagation of the heating wave results in an approximately 1.3% suppression of intensity, in semi-quantitative agreement with the suppression predicted. The 6300A intensity enhancements associated with o-mode propagation of the heating wave are far too large to be produced by ohmic heating, suggesting electron acceleration by strong plasma waves generated by the heating RF wave. The O(singlet D) lifetimes determined from the time constants of the 6300A intensity enhancement transients yield an F region quenching coefficient in good agreement with the Platteville I.M.E. and with laboratory results. (auth)

12407 ISSLEDOVANIIA PO GEOMAGNETIZMU I AERONOMII AVRORAL'NOI ZONY. (Studies of Auroral Zone Geomagnetism and Aeronomy). Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). 204p.

Recent theoretical and experimental investigations in the physics of the atmosphere in the upper-latitude regions are presented in a number of papers. Some of the topics covered include: the relation between electron fluxes in the magnetosphere and geomagnetic pulsations, the effect of internal gravity waves on the ionosphere, the main characteristics of the high-latitude F2 layer, the method of oblique incidence radio sounding for studying the horizontal inhomogeneity of the ionosphere, and radio wave propagation in the auroral zone. (IAA)

For abstracts of individual papers see: 12408–12423, 12438, and 12439.

12408 RELATION BETWEEN THE INTEGRAL BRIGHTNESS OF POLAR AURORAS AND CERTAIN PARAMETERS OF THE IONOSPHERE IN THE SUBAURORAL ZONE. Nekliudova, I. pp 12-16 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian).

12409 RELATION BETWEEN PULSATING AND NON-PULSATING COMPONENTS IN POLAR AURORA LUMINESCENCE INTENSITY. Fedoseev, V. I.; Chernous, S. A. pp 16-19 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12410 STRUCTURAL FORMATIONS IN THE IONOSPHERIC F REGION DURING RED TYPE-A POLAR AURORAS. Evlashina, L. M.; Evlashin, L. S. pp 20-27 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12411 EFFECTS OF LONGITUDE AND SEASON ON THE PROBABILITY OF POLAR AURORA OCCURRENCES. Molchanova, L. N.; Starkov, G. V.; Tishchenko, M. A. pp 27-32 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12412 AURORAL IONOSPHERIC DISTURBANCES IN DIFFERENT SEASONS. Sukhorukova, E. V. pp 33-48 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The present work discusses the basic considerations in studying the fundamental types of ionospheric disturbances; daytime positive disturbances, positive disturbances which are asymmetric with respect to local noon, nocturnal anomalous ionizations, and negative disturbances. These types of disturbance are discussed with respect to the time and season of their appearance, their intensities and durations, and the relations between them. The relationship between these disturbances and magnetic substorms is described, and some general explanations of the causes of these elementary disturbances are discussed. (IAA)

12413 EFFECT OF INTERNAL GRAVITY WAVES ON THE IONOSPHERE. Sukhorukova, E. V. pp 48-57 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The present work derives a formula for calculating the relative change in pressure when a gravity wave propagates through the atmosphere. The derivation is based on the theory of internal gravity waves for an idealized atmosphere proposed by Hines (1960). The formula is used to estimate the possible change in the ionospheric electron profile due to the effect of a pressure change. (IAA)

12414 CONDUCTIVITY OF THE HIGH LATITUDE IONOSPHERE IN QUIET AND DISTURBED PERIODS OF TIME. Astakhov, P. G.; Brunelli, B. E.; Liatskaia, A. M. pp 57-61 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12415 STUDY OF THE RELATION BETWEEN NIGHTTIME F-REGION IONIZATION AND MAGNETIC ACTIVITY. Shul'gina, N. V. pp 61-67 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

Two courses in the winter diurnal variation of F-region ionization have been discerned: in the first, an electron density maximum is reached during the day, while in the second, another maximum higher than the previous one is attained around midnight. It has been suggested (Brunelli et al., 1972) that the second course with its higher maximum is related to additional corpuscular radiation caused by increased magnetic activity. The present work presents data in the form of ionograms in order to verify this suggestion. It is shown that winter daytime ionization of the F2 layer after 1600 local time often changes anomalously and this anomalous ionization is preceded by one or two hours by increased magnetic activity. The appearance of sporadic formations in the F region was not found to have any correlation with magnetic activity. (IAA)

12416 SOME CHARACTERISTICS OF THE HIGH-LATITUDE F2 LAYER. Kukushkina, R. S. pp 75-81 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The present work describes the characteristic features of five critical periods of polar F2-region ionization: "polar peak" (noon maximum at geomagnetic latitude 75°), "auroral peak" (nighttime auroral maximum), "mid-latitude trough" (a minimum appearing in mid-latitude zone mainly at night), "winter spur" (winter daytime maximum at 55° latitude), and "mid-latitude increase" (twilight maximum at 60° latitude). Ionosonde data for the winter months of 1957 and 1958 form the basis of the study. Latitude distributions of electron concentration were determined for various levels of magnetic activity. (IAA)

12417 DETERMINATION OF THE OSCILLATORY TEMPERATURE OF MOLECULES FROM POLAR AURORA SPECTRA. Vlaskov, V. A. pp 81-86 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12418 AURORAL RADIO ECHO TYPES AND THEIR DYNAMICS DURING SUBSTORMS. Kozelova, T. V. pp 86-91 of Issledovaniia po geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12419 STATISTICAL CHARACTERISTICS OF THE ENVELOPE OF AURORAL BACK-SCATTERING AMPLITUDES AT A LAMBDA EQUAL TO 3.5 M. Stepanov, G. S.; Uspenskii, M. V.; Sverdlov, I. L. pp 91-101 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12420 DISCHARGE OF ENERGETIC ELECTRONS INTO THE TERRESTRIAL ATMOSPHERE ACCORDING TO MEASUREMENTS IN THE STRATOSPHERE. Lazutin, L. L.; Mel'nikov, A. O. pp 111-121 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12421 POSSIBILITIES OF THE OBLIQUE INCIDENCE RADIO SOUNDING METHOD IN DETERMINING THE PARAMETERS OF THE HORIZONTAL INHOMOGENEITY OF THE IONOSPHERE.

Tereshchenko, V. D. pp 121-130 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

An approximate method is worked out for determining the parameters of the horizontal inhomogeneity of the ionosphere at mid-latitudes and in the polar regions on the basis of oblique incidence ionospheric radiosonde data. The method can be used under two conditions: (1) the horizontal gradient is dependent on change in the height of the base and half-thickness of the ionospheric layer, and (2) the horizontal gradient depends on the critical frequency of the ionosphere. (IAA)

12422 HORIZONTAL ANISOTROPY OF THE RADIO AURORA. Zarnitskii, Yu. F.; Sverdlov, Yu. L. pp 161-169 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

An experiment is described in which data were obtained on the horizontal anisotropy of electron concentrations in the auroral zones. In the past, it has usually been concluded that there is no significant horizontal anisotropy, but in the present investigation it was shown that the horizontal anisotropic effect is masked by other phenomena. Analysis of echo signal data considered the probability of echo signal detection as a function of aspect sensitivity angle, the geomagnetic coordinates of the test station, and the threshold detection frequency of the station. (IAA)

12423 SOLUTION OF THE IONIZATION BALANCE EQUATION FOR AURORAL IONOSPHERIC CONDITIONS. Vlaskov, V. A.; Mingalev, V. S.; Mizun, Yu. G.; Uvarov, V. A. pp 169-186 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The present work derives a solution to the ionization balance equation for studying the effects during an ionospheric substorm of an electric field and heating of the upper polar atmosphere on the electron profile. This equation is solved simultaneously with the equations of motion for neutral particles, singly charged ions, and electrons. It is assumed that (1) the ionosphere is quasi-neutral and horizontally layered, (2) there is no vertical movement of neutral air, (3) collisions between electrons and ions can be neglected, (4) ion velocity is equal to electron velocity, (5) ion temperature is equal to the temperature of neutral particles, and (6) the electric field has a random orientation in space. It is shown that the appearance of an electric field associated with an ionospheric substorm results in a decrease in the height of maximum electron concentration and an increase in this concentration. (IAA)

12424 SECONDARY ELECTRON FLUXES BY PRECIPITATING ELECTRONS AND THE EXCITATION OF THE ATMOSPHERIC CONSTITUENTS IN THE DAYTIME AT MIDLATITUDE. Vlasov, M. N. (Inst. of Applied Geophysics, Moscow). J. Atmos. Terrest. Phys.; 36: No. 11, 1733-1738(Nov 1974).

From dynamics, chemistry, and thermal processes in the ionosphere and thermosphere symposium; Kyoto, Japan (Sep 1973).

For the precipitating electron fluxes with energy 1 to 40 keV, secondary electron fluxes within the energy range 7 to 20 eV are calculated. The precipitating electron flux is taken to be 0.3 erg cm^{-2} sec^{-1}. These calculations indicate that secondary electron fluxes within the energy range 7 to 16 eV are greater than the corresponding photoelectron fluxes at altitudes 110 to 150 km. The production rates of $O(^1S)$, $O(^1D)$, N_2 ($A^3\Sigma_u^+$, $a^1\Pi_g$, $b^1\Pi_u$, $B^3\Pi_g$, $h^1\Sigma_u^+$) excited species by these secondary electrons are presented. (auth)

12425 COLLIMATION OF AURORAL PARTICLES BY TIME-VARYING ACCELERATION. Hall, D. S.; Bryant, D. A. (Appleton Lab., Slough, Eng.). Nature (London); 251: No. 5474, 402-403(4 Oct 1974).

It is generally believed that charged particles aligned with the magnetic field, which occur in some forms of auroral precipitation, are collimated within a few thousand kilometers of the Earth's surface by an acceleration parallel to the geomagnetic field. Static electric fields are thought to provide this acceleration, and various charged particle injection modes have been suggested to account for the details of observed energy spectra and angular distributions. An alternative explanation is here proposed and examined theoretically involving a time varying acceleration of an incident stream of charged particles. In experimental work using a sounding rocket flown during the expansion phase of an auroral substorm, electrons collimated towards the direction of the local geomagnetic field were observed, and energy spectra were measured over the range 0.5 to 10 keV. Absence of sharp changes in slope of the energy spectrum curves and the angular distribution, together with collimation at energies below the peak of the energy spectrum, are not readily accounted for by acceleration in a static electric field. The authors were unable to propose a physical mechanism that would result in the postulated distribution of the energy gained by the particles, but a form of stochastic acceleration, or an acceleration by electric fields maintained by a time dependent anomalous resistivity, might possibly induce the effects. (UK)

12426 STATISTICAL CHARACTERISTICS AND DYNAMICS OF IONOSPHERIC IRREGULARITIES AS INVESTIGATED USING SATELLITE SIGNAL RECORDS AND GROUND-BASED METHODS AT MIDDLE AND HIGH LATITUDES. Misyura, V. A.; Svetlitchny, N. P.; Chasovitin, Y. K.; Shluger, S. S.; Bezrodnaya, L. V.; Gerasimova, N. D.; Piven, L. A.; Chernogor, L. F. (Kharkov State Univ.). J. Atmos. Terrest. Phys.; 36: No. 11, 2037-2045(Nov 1974).

From dynamics, chemistry, and thermal processes in the ionosphere and thermosphere symposium; Kyoto, Japan (Sep 1973).

Observations of radio signals from the artificial earth satellites are used to study F-region irregularities. The autocorrelation functions of fluctuations of Faraday angle and Doppler frequency shift are analyzed to obtain information about the ionospheric irregularity sizes. Distributions of correlation intervals depending on the local magnetic K-index and solar activity are presented. Profiles of electron density and collision frequency are obtained by a special facility. (auth)

12427 DYNAMICS OF THE F-REGION. Matuura, N. (Radio Research Lab., Nakaminato, Ibaraki, Japan). J. Atmos. Terrest. Phys.; 36: No. 11, 1963-1974(Nov 1974).

From second General Scientific Assembly of the IAGA; Kyoto, Japan (Sep 1973).

A discussion on the dynamics of the F region is given from viewpoints of thermospheric motions, plasma transport, their effects on the F-region variations, and electrodynamics. Dynamics of the F region are characterized by major heat sources arising from solar euv radiations and solar wind, and also by strong coupling between neutral and ionized constituents. Dynamical effects on diurnal, seasonal, and storm variations of the F region are briefly discussed. Dynamo action in the F region and resulting polarization electric field, electric current, thermospheric wind, plasma transport and plasma energetics are discussed. (auth)

12428 SOME IONOSPHERIC EFFECTS OF SOLAR FLARES. Subrahmanyam, C. V. (National Physical Lab., New Delhi). pp 151-158 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Doppler technique at 10 MHz was used for detection of sudden frequency deviations due to solar flare effects in the F-region. Some records of SSD's are shown. A new technique using the time variation of sudden cosmic noise during the decay phase following a solar flare is described. A quantitative estimation of the extent of the flare effect in the F-region is obtained. (auth)

12429 SOLUTION OF THE KINETIC EQUATION FOR IONOSPHERIC PHOTOELECTRONS WITH CONSIDERATION OF BOTH CONJUGATE REGIONS. Popov, G. V.; Khazanov, G. V. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 218-223(1974).

Translated from Kosm. Issled.; 12: No. 2, 241-246(1974).

An analytical solution of the kinetic equation for ionospheric photoelectrons in the energy range $E > 16$ eV with consideration of both conjugate regions of the ionosphere is examined. Some quantitative estimates of photoelectron pitch-angle distribution asymmetry are presented. This asymmetry occurs because of inhomogeneous atmospheric structure in certain limiting cases. (auth)

12430 THERMOBARIC PROPERTIES OF THE UPPER ATMOSPHERE IN THE POLAR REGION. Poloskov, S. M.; Tulinov, G. F.; Chanin, M. L.; Mailiard, M. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 224-227(1974).

Translated from Kosm. Issled.; 12: No. 2, 247-251(1974).

Results are presented of experiments in measurement of polar atmosphere temperature at heights of 120 to 170 km in a program of Franco–Soviet collaboration. A close relationship is established between heating effects and variations of the local geomagnetic field. On the basis of temperature data and the values of the diffusion coefficient density calculations are performed. A height distribution of thermobaric parameters is obtained, corresponding to the nighttime undisturbed thermosphere of the polar cap. An estimate is made of the seasonal effect in the temperature regime of the polar thermosphere. (auth)

12431 INVESTIGATION OF THE STATISTICAL CHARACTERISTICS OF THE INTENSITY FLUCTUATION OF HIGH-ENERGY ELECTRONS BY THE OREOL SATELLITE. Kuz'mina, V. A. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 205-212(1974).

Translated from Kosm. Issled.; 12: No. 2, 226-234(1974).

In addition to the intensity measurements of auroral and entrained electrons with energies in the ranges 28.8 to 54.2, 49.6 to 74.5, 69.8 to 103, and 103 to 161 keV, carried out by the satellite "OREOL" within the framework of the Soviet–French ARKAD experiment, an analysis was made of the statistical distributions of their intensity fluctuations for the purpose of verifying theoretical concepts concerned with the time nature of the particle ejection processes in the radiation belt and to search for deviations from a Poisson flux in the auroral zone. An averaged distribution is constructed of the electron energy fluctuations for the entrainment region, which coincided with a Poisson distribution. In the auroral zone, cases of deviation from a Poisson distribution are detected which, obviously, are associated with a fluctuating mechanism and not with a linear change of particle flux. (auth)

12432 SPORADIC SOURCE OF IONIZATION IN THE D AND E REGIONS OF THE NOCTURNAL IONOSPHERE AT MIDDLE LATITUDES. Tulinov, V. F.; Feigin, V. M.; Lipovetskii, V. A.; Zhuchenko, Yu. M. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 199-204(1974).

Translated from Kosm. Issled.; 12: No. 2, 219-225(1974).

The results are considered of rocket investigations into one of the sources of ionization of the nocturnal ionosphere—streams of "poured-out" electrons. The investigations were carried out at middle latitude of the Soviet Union (point "Volgograd") by means of equipment which permitted the energy spectrum of the electrons to be determined over the energy range 10^{-1} to 10^{3} keV. As a result, the parameters are investigated of a corpuscular source of ionization affecting the Earth's atmosphere in the region of altitudes 70 to 150 km in periods of low and increased solar activity, under complex conditions and with perturbations of the geomagnetic field, which has permitted the relative role of the streams of "poured-out" electrons in the formation of the nocturnal ionosphere to be determined at middle latitudes and under different geophysical conditions. (auth)

12433 IONOSPHERIC ABSORPTION CALCULATION BY JAEGER'S FORMULA WITH FINITE LIMITS. Misra, R. (Contai P.K. Coll., Midnapore, India); Chakravarty, B. Indian J. Phys.; 48: No. 6, 537-542(Jun 1974).

The limits of integration in Jaeger's formula has been changed from infinity to finite values for calculating transmission absorption at different layers of the ionosphere. The integral has been evaluated for different altitudes with a wave of frequency 5 MHz for solar zenith angle 28°. The values of absorption calculated with Jaeger's formula using the above values of the functions are compared graphically with those calculated by other formulas. (auth)

12434 VARIATIONS IN FLUX OF SOFT CORPUSCULAR RADIATION IN THE MESOSPHERE AT MIDLATITUDES. Tulinov, V. F.; Shibaeva, L. V.; Yakovlev, S. G. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 277-278(1974).

Translated from Kosm. Issled.; 12: No. 2, 304-305(1974).

Investigations of corpuscular radiation in the atmosphere at altitudes below 100 km have enabled one to determine that the value of the flux of electrons having energy $E \gtrsim 45$ keV in midlatitudes is $(3 \text{ to } 5) \cdot 10^{1}$ particles/cm^2 · sec, and can increase under perturbed conditions up to $\sim 7 \cdot 10^{2}$ particles/cm^2 · sec. Such fluxes can make a considerable contribution to ionization in the D region of the ionosphere. Results are presented of measurements of electron fluxes in the midlatitudes that are minimal from the point of view of their action on the D region. (auth)

12435 SATELLITE MEASUREMENTS OF AURORAL ALPHA PARTICLES. Sharp, R.D.; Johnson, R.G.; Shelley, E.G. (Lockheed Palo Alto Research Laboratory, Lockheed Missiles and Space Company, Inc., Palo Alto, California 94304). J. Geophys. Res. 79: No. 34, 5167-5170 (1 Dec 1974).

Energetic He^{++} ions were observed precipitating into the night side auroral zone on a satellite pass over the southern hemisphere on May 16, 1972, during a magnetic storm. The He^{++} spectrum was peaked near 1 keV/nucleon and was quite similar to that of the simultaneously observed protons when it was plotted versus velocity. The averaged alpha–to–proton ratio varied from $5.6 \pm 0.7\%$ in a latitudinal interval centered at $L = 7.3$ to $2.9 \pm 0.5\%$ in an interval centered at $L = 5.0$. It is concluded that the He^{++} ions and protons originated in the solar wind and were acted upon within the magnetosphere by adiabatic processes and that no substantial electrostatic acceleration occurred. (auth)

12436 AURORAL ELECTRON ENERGY DERIVED FROM RATIO OF SPECTROSCOPIC EMISSIONS. 1. MODEL COMPUTATIONS. Rees, M.H. (National Science Foundation, Washington, D. C. 20550); Luckey, D. J. Geophys. Res. 79: No. 34, 5181-5186 (1 Dec 1974).

The relationship between auroral electron fluxes and spectroscopic emission features in aurora is quantitatively explored. The model computations focus on the prominent auroral radiations of atomic oxygen at 6300 Å and 5577 Å and a vibrational band of ionized molecular nitrogen at 4278 Å. The emission rate ratios, 6300/4278, 5577/4278, and 6300/5577, together with the absolute emission rate of the 4278–Å radiation, may be used to infer a characteristic energy of the precipitating electron flux. This characteristic energy and the 4278–Å intensity then determine the total electron flux and the energy deposition rate. Computational results are presented in easily used curves, and the assumptions made in the model calculations are discussed in the text. At the present time it appears that the ratio 6300/4278 is the most reliable and informative of the set. (auth)

12437 TOP SIDE IONOSPHERIC SPREAD F AND PARTICLE PRECIPITATION IN THE DAY SIDE MAGNETOSPHERIC CLEFTS. Dyson, P.L. (La Trobe University, Bundoora, Victoria, Australia); Winningham, J.D. J. Geophys. Res. 79: No. 34, 5219-5230 (1 Dec 1974).

At high latitudes, top side ionospheric spread F is observed over a very large latitude range. Within this spread F region there is a severe top side irregularity zone (stiz) in which irregularities have larger amplitudes then elsewhere. Top side ionograms obtained within the stiz exhibit very severe frequency spread ($\gtrsim 1$ MHz) at zero range. The stiz occurs up to altitudes of at least 3000 km. Its equatorward edge is quite abrupt and is a good reflector of HF radio waves. Echoes from the stiz boundary have been observed by satellites as far as 2500 km equatorward. Comparisons of simultaneous top side sounder and particle data indicate that on the day side of the earth the equatorward boundaries of the stiz and of $\lesssim 300$–eV electron precipitation coincide. It is clear that the ionizing and heating effects of the particle precipitation produce irregularities, but other processes may also contribute. Usually, the stiz extends beyond the poleward boundary of the particle precipitation. This feature is probably due to magnetospheric convection transporting irregularities poleward of the region of production. (auth)

Magnetospheric Phenomena

Refer also to abstracts 11351 and 12231.

12438 RELATION BETWEEN IRREGULAR ELECTRON FLUXES IN THE MAGNETOSPHERE AND GEOMAGNETIC PULSATIONS. Afanas'eva, L. T.; Kuznetsov, S. N.; Raspopov, O. M. pp 3-12 of Issledovaniia po Geomagnetizmu i aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

The present work analyzes the relation between high-latitude pc4 and pc5 geomagnetic pulsations and the increase in intensity of high-energy electrons in the distant magntosphere. The study is based on daytime scintillation counter data obtained by the Electron-4 satellite from the period 11 July to 9 September 1964, and geomagnetic activity data from 23 auroral zone stations. The data show clearly that there exists a connection between pc5 pulsations and intense electron fluxes, as they always accompany one another, although such a relation is not readily apparent for pc4 pulsations and medium irregular electron fluxes. Observatory magnetograms were also used to study the relation between pi2 pulsations in the nighttime magnetosphere and the retarded recording of increased electron intensity on the day side. (IAA)

12439 PENETRATION OF PARTICLES INTO THE TERRESTRIAL ATMOSPHERE DURING SUDDEN GEOMAGNETIC STORM COMMENCEMENTS. Lazutin, L. L.; Mel'nikov, A. O.; Osepian, A. P. pp 101-111 of Issledovaniia po Geomagnetizmu i Aeronomii Avroral'noi Zony. Brunelli, B. E. (ed.). Leningrad; Izdatel'stvo Nauka (1973). (In Russian)

12440 NONLINEAR THEORY OF THE GENERATION OF NOISE BY ELECTRON BEAMS IN MAGNETOACTIVE PLASMA. Golikov, Yu. V.; Pustovalov, V. V.; Silin, V. P.; Tikhonchuk, V. T. Kratk. Soobshch. Fiz.; No. 3, 14-19(1974). (In Russian).

The spectral distribution and noise level generated by two opposing electron beams in a magnetoactive plasma were determined. Evaluations were made of the energy density of the oscillations at frequencies below the hybrid resonance in the region of the polar magnetosphere of the earth. The importance of the measurement of the oscillation at the turbulent noise level was indicated. (tr-auth)

12441 ENERGY INPUT TO THE LOWER THERMOSPHERE. Johnson, F. S. (Univ. of Texas, Dallas). J. Atmos. Terrest. Phys.; 36: No. 11, 1707-1713(Nov 1974).

From second General Scientific Assembly of the IAGA; Kyoto, Japan (Sep 1973).

The asymmetry in solar heat input to the upper atmosphere at the solstice and the asymmetry in atomic oxygen production are largely compensated by a large scale wind system towards the winter polar region. At magnetically disturbed times, atmospheric composition at high winter latitudes changes in such a way as to indicate that polar region heating by magnetic variations, energetic particle inputs, and current systems is more intense than

solar heating at low latitudes, thus leading to a reversal of the normal pattern of upper atmospheric circulation. Uncertainties in the intensity of solar radiation responsible for upper atmospheric heating and oxygen dissociation, and uncertainties in the degree of oxygen dissociation in the upper atmosphere are such that the average rates of eddy mixing may be significantly lower than frequently assumed for the lower thermosphere. (auth)

12442 INFLUENCE OF PRECIPITATING CHARGED PARTICLES ON THE HIGH LATITUDE THERMOSPHERE. Olson, W. P.; Moe, K. (McDonnell Douglas Astronautics Co., Huntington Beach, CA). J. Atmos. Terrest. Phys.; 36: No. 11, 1715-1726(Nov 1974).

From dynamics, chemistry, and thermal processes in the ionosphere and thermosphere symposium; Kyoto, Japan (Sep 1973).

The geographic extent of several observed thermospheric phenomena can be explained in terms of an energy source that is limited to the auroral and occasionally also the polar latitudes. Charged particles that precipitate into the high latitude thermosphere exhibit a similar dependence on latitude. This corpuscular radiation comes from three source regions in the magnetosphere: electrons and ions from the dayside cusps continuously precipitate to the dayside auroral latitudes; particles trapped in the tail of the magnetosphere intermittently precipitate to the nighttime auroral region; the polar caps occasionally receive corpuscular radiation from the lobes of the tail of the magnetosphere. These particles interact with the thermosphere in several ways that include the collisional excitation, dissociation, and ionization of atoms and molecules. Several observed thermospheric phenomena whose occurrences are highly dependent on latitude are compared with the predicted effects of the particle energy source. These include, thermospheric heating and concurrent changes in neutral atmospheric density, ionization and conductivity in the high latitude ionosphere, excitation of neutral particles, and optical emissions. (auth)

12443 HF DOPPLER OBSERVATION ASSOCIATED WITH MAGNETIC STORM. Ichinose, T. (Doshisha Univ., Kyoto); Ogawa, T. J. Atmos. Terrest. Phys.; 36: No. 11, 2047-2053 (Nov 1974).

From second General Scientific Assembly of the IAGA; Kyoto, Japan (Sep 1973).

Using the data of ionospheric disturbances correlated with a large sudden commencement and the geomagnetic fluctuation on August event, 1972 observed by oblique hf Doppler technique, the phase relationships between the frequency shifts and the geomagnetic variations on the basis of the theory as suggested by Jacobs and Watanabe (Radio Sci.; 1: 257(1966)) are investigated. As the result, at the sudden commencement, the phase relation between the derivative of the geomagnetic horizontal component and the Doppler shift is in phase, and on the fluctuation, the phase relation is in opposition about the Doppler shift and geomagnetic variations. The calculated values of the Doppler shift almost coincide with the observational results now reported. (auth)

12444 NORTH-SOUTH ASYMMETRY OF GEOMAGNETIC AND TROPOSPHERIC EVENTS. Mansurov, S. M.; Mansurova, L. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). J. Atmos. Terrest. Phys.; 36: No. 11, 1957-1962(Nov 1974).

From dynamics, chemistry, and thermal processes in the ionosphere and thermosphere symposium; Kyoto, Japan (Sep 1973).

The influences of the solar plasma on geomagnetic and atmospheric phenomena are considered. There is the north-south asymmetry in the reaction of the geomagnetic field, of the geopotential and of the pressure in the magnetically conjugate points relative to the direction of the interplanetary magnetic field. There is the synchronism between direction of the meridional component of wind at the level of the tropopause and the direction of the interplanetary magnetic field. (auth)

12445 EVOLUTION OF DISTURBANCE DAILY VARIATION (DS) AND INTERPLANETARY PLASMA PARAMETERS. Kane, R. P. (Physical Research Lab., Ahmedabad, India). Proc. Indian Acad. Sci., Sect. A; 80: No. 3, 124-139(Sep 1974).

The evolution of DS during the storms of February 7 and February 16, 1967 and October 31, 1968 is studied. It is shown that DS usually evolves as a morning maximum and a dusk minimum but not necessarily simultaneously. Also, the maxima and minima may shift to other LT sectors too. DS continues to be high even in the recovery phase and generally ends up as a noon-time decrease. DS seems to be related with solar wind parameters N and V but not with interplanetary magnetic field. (auth)

12446 VISCOUS-LIKE INTERACTIONS IN THE MAGNETOSPHERE. Kalra, G. L. (Univ. of Delhi). pp 251-261 of Solar Radiations and the Earth. Delhi; Hindustan Publishing Corp. (1973).

Various macro- and microscopic theories for the transfer of solar wind momentum into the magnetosphere are examined. The existing theoretical analyses yield a value of effective viscosity which is comparable to the value required by the Axford and Hines (1961) unified model of high latitude geophysical phenomena. (auth)

12447 PRECIPITATING LOW ENERGY PROTONS AND THE 80 TO 120 KM ATMOSPHERE ABOVE KIRUNA. Brini, D.; Evangelist, F.; Fulgni, F.; Horstman, H. (CNR, Laboratorio TESRE, Bologna). Riv. Ital. Geofis.; 23: 15-18(1974).

A review is given on the charged particle flux measurements performed at altitudes from 80 to 120 km above Kiruna, Sweden, by described detectors on board a rocket launched in June 1969. Identified as low energy protons, these particles show an exponential spectrum similar to that measured during polar cap absorption events, though much softer. A large discrepancy is shown to exist between the derived proton densities and those tabulated standard model atmospheres. (IAA)

12448 TOPOLOGICAL MODEL OF THE MAGNETOSPHERIC SUBSTORM. Nagata, T. (National Inst. of Polar Research, Tokyo). Riv. Ital. Geofis.; 23: 37-42(1974).

It is shown that a simple cusp catastrophe model can reasonably well explain the occurrence of a single isolated magnetospheric substorm as the result of a continuous energy input from the solar wind into the magnetosphere and as a continuous process of energy storage within the magnetotail region. Modifications of this model are suggested to account for geyser-like substorms occurring intermittently at time intervals of several hours. (IAA)

12449 PHYSICAL PROPERTIES OF THE DISTANT GEOMAGNETIC TAIL. Villante, U. (Univ., L'Aquila, Italy). Riv. Ital. Geofis.; 23: 27-35(1974).

A critical review is presented on the physical properties of the 500-to-1000 distant geomagnetic tail in light of the reported Pioneer-7 and Pioneer-8 observation data, and the latter are compared with suggested theoretical models. The distant tail is interpreted as a smooth extension of the near-Earth and cislunar tails. The most important new feature is the persistent, low-density plasma flow whose distribution function is occasionally double-peaked. The velocity of the tail plasma is lower than that of the external solar wind. The neutral sheet population is composed of more energetic protons. Evidence for a wake region and for a distant magnetosheath is also presented. (IAA)

12450 VARIATIONS IN PROTON PITCH-ANGLE DISTRIBUTION IN THE OUTER REGIONS OF THE RADIATION BELT. Kovtyukh, A. S.; Panasyuk, M. I.; Sosnovets, E. N. Cosmic Res. (USSR) (Engl. Transl.); 12: No. 2, 213-217(1974).

Translated from Kosm. Issled.; 12: No. 2, 235-240(1974).

The change in pitch-angle distribution of low-energy (65 to 650 keV) proton fluxes in the outer regions of the radiation belt ($4 < L < 7$) is examined, using data from the satellite Molniya 1 during the magnetic storm of March 19, 1973. It is shown that the variations observed may be related to the development of strong pitch-angle diffusion under conditions of increased magnetic activity. (auth)

12451 ELECTRON DENSITIES BETWEEN 110 AND 300 KM DERIVED FROM SOLAR EUV FLUXES OF AUGUST 23, 1972. Heroux, L.; Cohen, M.; Higgins, J.E. (Air Force Cambridge Research Laboratories (AFSC), L. G. Hanscom Field, Bedford, Massachusetts 01730). J. Geophys. Res. 79: No. 34, 5237-5244 (1 Dec 1974).

Solar radiation in the wavelength region 1220-52 Å emitted from the whole solar disk has been measured by a rocket spectrometer flown from White Sands Missile Range on August 23, 1972. The intensities have been corrected for atmospheric absorption. The estimated errors in the intensities are ±30% between 1220 and 150 Å and ±50% between 150 and 52 Å. These data have been used to calculate electron densities in the altitude region 110-300 km. The calculated electron densities are in good agreement with densities measured by an ionosonde during the rocket flight. (auth)

12452 DEFORMATION OF THE NIGHT SIDE PLASMASPHERE AND IONOSPHERE DURING THE AUGUST 1972 GEOMAGNETIC STORM. Brace, L.H.; Maier, E.J.; Hoffman, J.H.; Whitteker, J.; Shepherd, G.G. J. Geophys. Res. 79: No. 34, 5211-5218 (1 Dec 1974).

Isis 2 satellite measurements of electron and ion temperatures and densities and of airglow emissions have resolved certain features of the response of the night side ionosphere to the major magnetic storm of August 4-6, 1972, an event in which Kp reached 9o at one point. The near-polar orbit of Isis 2 is circular at about 1400-km altitude and at the time of the storm was oriented in the 0500-1700 LT plane. During the initial phases the plasmapause moved equatorward from L=4.5 to about 2.7, followed by a further compression to L=1.9-2.0 at the peak

of the storm and a slow recovery during the ensuing days. The plasmapause was identified by an abrupt decline in H^+ accompanied by a sharp peak in both T_e and T_i, T_e approaching 6000°K and T_i exceeding 3000°K in some passes. A pronounced trough developed within the plasmasphere during the days of greatest disturbance. Equatorial temperatures were also enhanced from normal values, T_e exhibited great spatial variation there on some passes, and this variation was associated with the development of troughs of N_e at the dip equator. On the most disturbed day (August 5), when the plasmapause had fallen to L=2.3, a deep trough developed in the region L=1.3−1.8, N_e falling below 1×10^2 cm^{-3}, more than 2 orders of magnitude below the normal protonosphere concentration at this altitude. Top side sounder observations of radio breakthrough from the ground indicated that the trough extended through the F region as well. A red arc observed on this day at L=1.23 apparently was associated with an equatorial trough in N_e and enhancement in T_e. Whether the arc and the troughs were caused by magnetospheric processes or by enhanced recombination within the F region is not clear. (auth)

12453 CORRELATED SATELLITE MEASUREMENTS OF PROTON PRECIPITATION AND PLASMA DENSITY.
Søraas, F.; Berg, L.E. (Department of Physics, University of Bergen, Bergen, Norway). J. Geophys. Res. 79: No. 34, 5171-5180 (1 Dec 1974).

The main experimental findings relating plasma densities in the equatorial plane (Ogo 5) to proton precipitation at high latitudes (Esro 1A), obtained from nearly simultaneous observations in the evening/midnight local time sector, can be summarized as follows: When the plasma density is high out to large L values, most common during quiet geomagnetic conditions, the greater than 100−keV proton precipitation has no sharp equatorward boundary. The change from an anisotropic pitch angle distribution peaked at 90° with the magnetic field lines to an isotropic one is gradual with increasing L. When a sharp plasmapause is detected and the plasma density outside the plasmapause is low, there is a region outside the plasmapause where the proton flux is highly anisotropic. A rather abrupt transition to an isotropic pitch angle distribution takes place at approximately 1 R_E outside the plasmapause. There is thus a region outside the plasmapause where the proton population is stable to precipitation losses. The high−energy protons reach their peak precipitation rate at lower L values than the low−energy protons do. An example where the precipitation pattern consists of two regions, one in the auroral zone and one at lower L values, both having increased plasma density, is presented. The spatial and energy dependence of the proton precipitation pattern shows that the proton population is stable to precipitation losses in regions where the magnetic energy per particle roughly exceeds the energy of the observed protons. In regions where the magnetic energy per particle is less than the energy of the protons, the protons can precipitate with either an isotropic or an anisotropic pitch angle distribution. The on−off switch thus seems to be controlled by the relation of particle energy to magnetic energy per particle, whereas the strength of the precipitation in the on state is otherwise determined. (auth)

12454 SUPPORT FOR CRAND THEORY FROM MEASUREMENTS OF EARTH ALBEDO NEUTRONS BETWEEN 70 AND 250 MeV. Kanbach, G.; Reppin, C.; Schönfelder, V. (Max−Planck−Institut für Physik und Astrophysik, Institut für extraterrestrische Physik, Garching/Munich, Germany). J. Geophys. Res. 79: No. 34, 5159-5166 (1 Dec 1974).

The results of high-energy neutron measurements during two balloon flights on May 1 and 25, 1971, from Palestine, Texas, are reported. At atmospheric depths of 8.6 and 4.7 g cm^{-2} we obtained the energy and angular distribution of atmospheric neutrons between 70 and 250 MeV. The upward moving part, in terms of the albedo neutron leakage current, can be described by $J_{2\pi}=2.53\cdot E^{-1.89}$ neutron/cm^2 s MeV in this energy range. The angular distribution of the neutron flux shows a pronounced peak in the horizontal direction (zenith angle, 90°) with a full width at half maximum of about 30°. The measured energy spectrum is in good agreement with results of recent Monte−Carlo calculations on atmospheric neutrons. Together with the angular distribution it also confirms theoretical estimates of the albedo neutron source strength required in a Crand (cosmic ray albedo neutron decay) theory where the high−energy protons in the earth's inner radiation belt are injected by decaying neutrons. The instrument used employs a double scattering technique and has been calibrated at the synchrocyclotron of the Atomic Energy Research Establishment, Harwell, England. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

12455 SURFACE AND VACUUM PHYSICS INDEX. Volume 9, No. 8, 1974. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1974). 54p.

Beams and Their Reactions

Refer also to abstracts 11027, 12105, 13033, 13062, and 13085.

12456 (ORO-2591-72) FORMATION OF EXCITED HYDROGEN ATOMS BY CHARGE TRANSFER AND DISSOCIATION. Progress Report No. 10, December 1, 1973–November 1, 1974. Thomas, E. W.; Sauers, I.; Zivitz, M.; Baird, W. E. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). 1974. Contract AT(40-1)-2591. 14p. Dep. NTIS $4.00.

This program is primarily concerned with formation of excited atoms when H^0, H^+, H_2^+ and He^+ projectiles strike surfaces and when they collide with gases; some measurements on charge changing reactions were also performed. Impact of 5 to 30-keV H^+, H_2^+, and He^+ ions on metal surfaces gives rise to Doppler-broadened spectral lines of H and He which may be analyzed to provide the distributions in speeds and directions of scattered particles. It was observed that slow excited particles are de-excited by a quantum tunneling mechanism; measurements of the probability of tunneling for various metallic targets agree well with theory. Some radiation damage to the targets (blistering and pitting) was observed. (DLC)

12457 THE ORIENTATION DEPENDENCE OF THE ELECTRON BACKSCATTERING COEFFICIENT OF GOLD SINGLE CRYSTAL FILMS. Drescher, H.; Krefting, E. R.; Reimer, L.; Seidel, H. (Muenster Univ. (F. R. Germany). Elektronenmikroskopische Abt.). Z. Naturforsch., a; 29: No. 6, 833-837 (Jun 1974). 7 figs.; 1 tab.; 13 refs.

A theory is developed for calculating the orientation dependence of the backscattering coefficient of single crystal films. Three contributions are calculated separately; firstly the direct backscattering out of the Bloch wave field, secondly the backscattering of electrons scattered out of the wave field into angles smaller than 90°, and thirdly the remaining fraction of electrons scattered into very small angles. The electron diffusion is considered by Monte-Carlo calculations. The theory is compared with experiments on gold single crystal films on a mica substrate. For primary electron energies below 6 keV, a decrease of the orientation anisotropy of backscattering is observed with decreasing energy, whereas Si and Ge single crystals show a further increase. This decrease agrees with numerical calculations using cross sections for low energies. (auth)

12458 MULTIPLE SCATTERING OF HEAVY IONS OF keV ENERGIES TRANSMITTED THROUGH THIN FILMS. Andersen, H.H.; Bøttiger, J.; Knudsen, H.; Møller Petersen, P. (Institute of Physics, University of Aarhus, DK–8000 Aarhus C, Denmark); Wohlenberg, T. Phys. Rev. A 10: No. 5, 1568-1577 (Nov 1974).

This paper describes experimental studies of the multiple scattering of a number of different ions with $1 < Z_1 < 18$ and 500 keV incident energy, transmitted through thin films of Se, Pd, Ag, Te, Ta_2O_5, and Bi, and foils consisting of a mixture of C and Au atoms. We found that the targets fell into two groups with respect to structure. The first group, in which the targets were amorphous or had very small crystallites, showed multiple-scattering distributions of heavy ions, in agreement with current theory. In the second group, where the targets had grain sizes larger than approximately 100 Å, the distributions were consistently narrower than those predicted theoretically. Possible mechanisms responsible for the deviations were investigated. (auth)

12459 CHANNEL T AND K OPERATORS AND THE HEITLER DAMPING EQUATION FOR IDENTICAL–PARTICLE SCATTERING. Kouri, D.J. (Max–Planck–Institut für Strömungsforchung, 3400 Göttingen, Böttingerstr. 6/8, Federal Republic of Germany); Levin, F.S. Phys. Rev. A 10: No. 5, 1616-1622 (Nov 1974).

Coupled integral equations linking the direct and exchange (rearrangement) K operators are proposed in analogy to similar ones linking the direct and exchange T operators derived in this paper. It is shown that these pairs of coupled equations lead to the damping equation which was used in previous work on identical-particle scattering and which expresses the unitarity condition. Other formulations of integral equations for the K operator are also discussed. (auth)

12460 MOMENTUM MODULATION OF A FREE ELECTRON BEAM WITH A LASER. Piestrup, M.A.; Rothbart, G.B.; Fleming, R.N.; Pantell, R.H. (Department of Electrical Engineering, Stanford University, Stanford, California 94305). J. Appl. Phys. 46: No. 1, 132-137 (Jan 1975).

A Nd : YAG laser has been used to modulate the energy of a free electron beam. With a single pass of the 2–MW laser light through the 100–MeV electrons we have measured a 37–keV increase in the width of the energy spectrum for the particles. The interaction occurred in helium at standard temperature and pressure over a distance corresponding to 10^5 optical wavelengths, and a phase synchronism condition was maintained by means of the inverse Cerenkov effect. That is, along the direction of motion of the electrons the phase velocity of the electromagnetic wave equaled the electron velocity. Therefore, the electrons remained in an electric field of constant phase, resulting in significant energy exchange. (auth)

12461 TOTAL BACKSCATTERING OF PROTONS FROM GOLD. Sidenius, G. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett., A; 49: No. 5, 409-410 (7 Oct 1974).

The total backscattering of protons from gold has been measured in the energy range 5 to 50 keV. Both the reflection coefficient, efficiency and energy spectrum is obtained by application of a low pressure proportional counter technique. (auth)

Atomic and Molecular Properties

Refer also to abstracts 11831, 11873, 11934, 12069, 12488, 12489, 12491, 12692, and 12882.

12462 (CONF-740737-1) PHOTOELECTRONS: COUNTERPARTS OF ROENTGEN RAYS. Krause, M. O. (Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From international conference on x-ray processes in matter; Otaniemi, Finland (29 Jul 1974).

Characteristics of the PAX method, which is based on the photoelectric effect, are described and exemplified by a number of measurements. PAX, photoelectron spectrometry for the analysis of x rays, is shown to have merits, particularly in the soft and ultrasoft x-ray regions. (auth)

12463 CONFIGURATION INTERACTION STUDIES OF THE HeH^+ MOLECULAR ION. I. SINGLET SIGMA STATES. Green, T.A. (Sandia Laboratories, Albuquerque, New Mexico 87115); Michels, H.H.; Browne, J.C.; Madsen, M.M. J. Chem. Phys. 61: No. 12, 5186-5197 (15 Dec 1974).

The method of superposition of configurations is applied to the singlet sigma states of HeH^+ which correlate to the separated atom states of principal quantum number less than or equal to 3. The calculations are carried out for internuclear separations in the ranges 0(0.1)34.5 and 35.0(0.5)50.0 bohr. Energy eigenvalues and the expectation values of the electron coordinate along the internuclear line are discussed in this paper. Dipole transition matrix elements and radial coupling matrix elements are presented in a companion paper. The quality of the calculations is exhibited by comparisons of the length and velocity forms of the dipole matrix elements, by the Hellmann–Feynman theorem, and by the approach to atomic properties at large internuclear separations. Supplementary calculations of higher quality wavefunctions for the lowest states are also reported. These are used to help estimate the extent to which the results of the main calculations have converged toward the exact values. Comparisons with other work are given. It is shown that for internuclear separations greater than about 3 bohr a one–electron model potential approach is quite successful for the excited states. At smaller internuclear separations, and as the united atom limit is approached, current model potential methods cannot be trusted. In this region the model potential, being based on the separated atoms, cannot describe the actual changing charge distributions of the core electron. This work demonstrates the feasibility, for simple systems, of the ab initio structure calculations required for the quantitative description of low–energy atom–atom collisions. (auth)

12464 CONFIGURATION INTERACTION STUDIES OF HeH^+ MOLECULAR ION. II. DIPOLE AND RADIAL COUPLING MATRIX ELEMENTS FOR THE SINGLET SIGMA STATES. Green, T.A. (Sandia Laboratories, Albuquerque, New Mexico 87115); Browne, J.C.; Michels, H.H.; Madsen, M.M. J. Chem. Phys. 61: No. 12, 5198-5204 (15 Dec 1974).

Configuration interaction calculations of the dipole, gradient, and radial coupling matrix elements among the lowest 10–12 $^1\Sigma$ states of HeH^+ are reported for internuclear separations in the range $0 \leq R \leq 50$ a.u. The forms $\langle n|\partial/\partial R|m\rangle$ and $(E_m - E_n)^{-1}\langle n|\partial V/\partial R|m\rangle$ of the radial

coupling element are compared. The results are compared with those of other investigators. The accurate evaluation of these matrix elements in the present work demonstrates the feasibility of a quantitative ab initio treatment of low-energy collisions between light atoms. (auth)

12465 NUCLEAR QUADRUPOLE COUPLING IN THE HYDROGEN MOLECULE: A MOLECULAR ORBITAL DESCRIPTION. Snyder, L.C. (Bell Laboratories, Murray Hill, New Jersey 07974). J. Chem. Phys. 61: No. 12, 5032-5034 (15 Dec 1974).

The electric field gradient at a nucleus of H_2 has been computed from an SCF determinantal wavefunction in a Gaussian orbital basis set centered at the nuclei. It is found that both p and d polarization functions must be added if the true electric field gradient is to be represented within a few percent. (auth)

12466 INTERFERENCE EFFECTS IN NEUTRON AND X RAY SCATTERING. Glyde, H. R. (Chalk River Nuclear Labs., Ont.). Can. J. Phys.; 52: No. 22, 2281-2298(15 Nov 1974).

The properties of interference between the one and multiphonon contributions to the dynamic and static scattering functions, $S(Q,\omega)$ and $S(Q)$, first considered by Ambegaokar et al., are discussed in detail for bcc ^{3}He and ^{4}He for comparison with recent neutron and proposed x ray scattering experiments. Calculations of interference for Na and of the Debye temperature appropriate to the Debye-Waller factor in bcc ^{3}He are also presented. In all cases the on shell interference term which alters the one phonon scattering intensity is found to be more important than the off shell term which alters the one phonon line shape. This is characteristic of systems in which anharmonic effects produce a large phonon frequency shift but in which the phonon lifetimes remain long. The difficulty in establishing the one phonon sum rules experimentally in the presence of interference is emphasized. As noted by Horner, existing unusual variations of scattering intensity observed in solid ^{4}He can be satisfactorily explained by taking account of interference and this difficulty without introducing an anomalous Debye-Waller factor. Comparisons with liquid ^{4}He suggest a similar difficulty in establishing the sum rules there. (auth)

12467 4f STATES IN LANTHANUM. Mariot, J. M.; Karnatak, R. C. (Univ., Paris). J. Phys., F (London); 4: No. 10, L223-L224(Oct 1974).

The lanthanum M_{IV} and M_V x-ray emission spectra were studied. These spectra indicate the existence of highly localized 4f states near the Fermi level. (auth)

12468 MAGNETIC MOMENTS OF THE $3p^5$ CONFIGURATION OF ATOMIC CHLORINE. Uslu, K. A.; Code, R. F.; Harvey, J. S. M. (Univ. of Toronto). Can. J. Phys.; 52: No. 21, 2135-2142(1 Nov 1974).

The paramagnetic resonance spectra of the ground $^2P_{\frac{3}{2}}$ and excited $^2P_{\frac{1}{2}}$ levels of both isotopes, ^{35}Cl and ^{37}Cl, of atomic chlorine were observed. The off-diagonal magnetic dipole coupling constant $A_{\frac{3}{2},\frac{1}{2}}$ and the metastable state g factor $g_j(^2P_{\frac{1}{2}})$ were evaluated from measurements on selected transitions to an accuracy of about two parts per million in the transition frequency. The magnetic dipole radial parameters $\langle r_{01}^{-3}\rangle$, $\langle r_{12}^{-3}\rangle$, and $\langle r_{10}^{-3}\rangle$ for chlorine are calculated. (auth)

12469 CALCULATION OF THE FINE STRUCTURE OF THE $a\,^3\Sigma_u^+$ STATE OF MOLECULAR HELIUM. Beck, D.R. (Becton Center, Department of Engineering and Applied Science, Yale University, New Haven, Connecticut 06520 and Belfer Graduate School of Sciences, Yeshiva University, New York, New York 10033); Nicolaides, C.A.; Musher, J.I. Phys. Rev. A 10: No. 5, 1522-1527 (Nov 1974).

Using a published correlated wave function computed by Poshusta and Matsen, we have obtained a vibrationally averaged first-order spin-spin constant of -0.04089 cm^{-1} for the a $^3\Sigma_u^+$ metastable state of molecular helium. This is in good agreement with the experimental value of -0.0367 cm^{-1} recently reported by Lichten et al. Our results strongly suggest that second-order spin-orbit effects are small. (auth)

12470 SOLUTION OF THE DIRAC EQUATION WITH TWO COULOMB CENTERS. Mueller, B.; Rafelski, J.; Greiner, W. Nukleonika; 19: No. 7-8, 741-746(1974).

The Dirac equation for a relativistic particle (electron) in the field of two Coulomb centers, Z_1 and Z_2—pointlike as well as extended charges—was solved. The systems Br-Br, I-Au, U-U are shown as examples. (3 figures) (auth)

12471 CHARGED VACUUM IN OVERCRITICAL FIELDS. Rafelski, J.; Mueller, B.; Greiner, W. (Univ., Frankfurt am Main). Nukleonika; 19: No. 7-8, 747-765(1974).

The concept of overcritical fields, i.e. fields in which spontaneous, energyless electron-positron pair creation may occur, is discussed. It is shown that only a charged vacuum can be a stable ground state of the overcritical field. The time-dependent treatment confirms previous results for the cross sections for the autoionizing positrons. The questions in connection with the classical Dirac wave functions in overcritical fields are extensively discussed in the framework of the self-consistent formulation of QED including the effects of vacuum polarization and self-energy. (3 figures) (auth)

12472 NEW SOURCE OF ATOMIC URANIUM FOR ABSORPTION SPECTROSCOPY AND OTHER APPLICATIONS. Engleman, R. Jr. (Los Alamos Scientific Lab., NM). Spectrosc. Lett.; 7: No. 11, 547-550(1974).

The absorption spectrum at atomic uranium was observed at high resolution in the regions between 411 and 478 nm. The method of flash photolysis of uranium borohydride compounds, $U(BH_4)_4$ and $U(BH_4)_3$ (BH_3CH_3), was used. Possible uses suggested are oscillator strength measurements, a source of simple uranium-containing molecular spectra, and as a source of atomic uranium. (JFP)

12473 ELECTRON RESONANCES ASSOCIATED WITH THE LYMAN SYSTEM OF H_2 AND D_2. McGowan, J. M. (Univ. of Western Ontario, London); Williams, J. F.; Meckbach, W. Can. J. Phys.; 52: No. 21, 2076-2082(1 Nov 1974).

The high resolution electron impact excitation of the H_2 and D_2 Lyman bands was investigated. Particular attention was paid to two series of $(H_2^{-2}\,\Sigma_d^+)$ resonances which decay into the $B^1\Sigma_u^+(v')$ states. (auth)

12474 CALCULATION OF DIFFERENTIAL EXCITATION AND IONIZATION COEFFICIENTS FOR CESIUM ATOM. Collins, C. B.; Brandus, L. (Inst. of Physics, Bucharest). Rev. Roum. Phys.; 19: No. 5, 501-504(1974).

The calculation of differential excitation and ionization coefficients for cesium atom is considered. (auth)

12475 QUANTUM NUMBERS AND THE UNIVERSAL POTENTIAL FOR IONIZED STATES. Gaspar, R. (Kossuth Lajos Univ., Drebecen, Hungary); Jucys, A.; Glembockis, J.; Petkevicius, J. Acta Phys. Acad. Sci. Hung.; 36: No. 3, 331-337(30 Sep 1974).

Possibilities of the modified WKB method in which the universal potential is used are studied for the investigation of atoms in various states of ionization. The calculations are performed with three modifications of the universal potential for the iron atom in ground configurations till fivefold ionization. (auth)

12476 OBSERVATION OF QUASISTEADY STATES OF ATOMS IN A STRONG LIGHT FIELD. Alimov, P. T.; Delone, N. B. Kratk. Soobshch. Fiz.; No. 2, 24-28(1974). (In Russian).

It was experimentally detected that, as a function of the radiation frequency, the process of multiphoton ionization of atoms of Xe at intensities of the field of the order of 5×10^7/cm can have both a direct and a resonance character. The intermediate multiphoton resonance appears with strongly perturbed quasisteady states of the electron in the atom. (tr-auth)

12477 CALCULATION OF SLATER INTEGRALS FOR HYDROGENIC WAVE FUNCTIONS. Brandus, L. (Inst. of Physics, Bucharest). Rev. Roum. Phys.; 19: No. 5, 497-500(1974).

A method for the determination of Slater integrals for hydrogenic wave functions is considered. (auth)

12478 SOFT X-RAY APPEARANCE POTENTIAL SPECTRA OF THE $N_{4,5}$ TRANSITIONS IN LANTHANUM. Szczepanek, P. S.; Harte, W. E. (Maryland Univ., College Park (USA)). Phys. Lett., A; 49: No. 5, 377-378(7 Oct 1974).

Structure is observed in the soft X-ray appearance potential spectrum of lanthanum near the $N_{4,5}$ binding energy. This structure is due to exchange splitting caused by the overlap of the 4d and 4f wavefunctions as modified by the incident electron. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstract 12855.

12479 DISCREPANCY BETWEEN THEORY AND EXPERIMENTS IN MUONIC X RAYS: A CRITICAL DISCUSSION. Watson, P. J. S.; Sundaresan, M. K. (Carleton Univ., Ottawa). Can. J. Phys.; 52: No. 20, 2037-2059(15 Oct 1974).

The discrepancy between theoretical and experimental x-ray energies in muonic atoms is reviewed. Brief descriptions of all the known corrections, such as finite size, vacuum polarization, and electron screening are given, and an attempt is made to estimate the theoretical errors. The discrepancy is found to remain at the two standard deviation level in eight transitions, and some speculations are offered on the resolution of the problem. (auth)

12480 KAON-NUCLEUS INTERACTION AT LOW ENERGIES. Deloff, A.; Law, J. (Department of Physics, University of

Guelph, Guelph, Ontario, Canada). Phys. Rev. C 10: No. 5, 1688-1696 (Nov 1974).

A kaon–nucleus absorptive potential is derived by folding the $\bar{K}N$ finite-range complex potential into the nuclear density distribution. The strengths of the $\bar{K}p$ and $\bar{K}n$ potentials have been adjusted to the corresponding scattering length values, and the range of the $\bar{K}N$ forces has been obtained by fitting the $\bar{K}-{}^4He$ scattering data. The resulting $\bar{K}N$ potential with no free parameters has been used to calculate kaonic atom level shifts and widths. Within the experimental uncertainties all kaonic data can be fitted in a consistent manner. (auth)

12481 POSITRONFIT EXTENDED: A NEW VERSION OF A PROGRAM FOR ANALYZING POSITRON LIFETIME SPECTRA. Kirkegaard, P.; Eldrup, M. (Danish Atomic Energy Commission, Risoe. Research Establishment). Comput. Phys. Commun.; 7: No. 7, 401-409 (Jul 1974).

The first version of the program POSITRONFIT which was developed to perform a least-squares analysis to extract positron lifetimes and their relative intensities from measured positron lifetime spectra was previously described in detail. The analysis was among other things based on the assumption that the time resolution curve of the measuring system is a gaussian. In many cases this approximation is justified, but in some cases the deviation from this shape is so large that it may strongly influence the results of the analysis. This difficulty was overcome in the new version of the program in which the resolution curve is described as a sum of gaussians. By allowing different widths, intensities, and centroid positions for the components, it is possible to reproduce any usual resolution curve. (auth)

Collision Phenomena

Refer also to abstracts 12463, 12464, and 12473.

12482 (CONF-741040-11) ENERGY DEPENDENCE OF THE ANISOTROPY OF THE NONCHARACTERISTIC X-RAYS EMITTED IN FAST ION-ATOM COLLISIONS. Thoe, R. S.; Sellin, I. A.; Brown, M. D.; Forester, J. P.; Griffin, P. M.; Pegg, D. J.; Peterson, R. S. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., Tenn. (USA)). 1974. 17p. Dep. NTIS $4.00.

From third conference on the use of small accelerators; Denton, Texas, USA (21 Oct 1974).

The effect of beam velocity and K-shell binding energy on the angular distributions of the noncharacteristic x radiation emitted for various collision pairs was measured. The results are in general agreement with the calculations of Müller and Greiner, in that the anisotropy increases rapidly with energy, provided that the ions are still moving slowly, compared to the velocity of the K-shell electrons of the separated atoms. The anisotropy in some cases exceeds the maximum permitted by the Müller-Greiner model for the zero alignment case, implying that strong alignment phenomena also occur. (auth)

12483 (COO-3416-14) ION-MOLECULE REACTIONS IN MONOSILANE–ACETYLENE MIXTURES. Mayer, T. M.; Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Davey Lab.). 1973. Contract AT(11-1)-3416. 24p. Dep. NTIS $4.25.

The reactions of Si^+, SiH^+, SiH_2^+, and SiH_3^+ with C_2H_2 and the reactions of $C_2H_2^+$ with SiH_4 were studied as a function of collision energy in the range of 0.3 to 2.5 eV in the center-of-mass system by tandem mass spectrometry. Phenomenological rate constants were measured in the low energy region of 0.3 to 0.9 eV in which the polarization theory cross section dependence on energy of the form $\alpha\ \sigma\ E^{-1/2}$ seems to be reasonably valid. High pressure mass spectrometry in the range of 0.04 to 0.3 torr for a mixture containing 10% of acetylene indicates that acetylene has a striking effect on the ionic chemistry of monosilane. Above 0.05 torr, the principal reaction of acetylene with ions derived from monosilane appears to be that of simple association, leading to ionic polymerization of acetylene. (auth)

12484 (COO-3416-15) ION–MOLECULE REACTIONS IN METHYLSILANE. Mayer, T. M.; Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Davey Lab.). 1973. Contract AT(11-1)-3416. 42p. Dep. NTIS $5.25.

Positive ion-molecule reactions in methylsilane were investigated by tandem and high pressure mass spectrometry. Reaction identification and rate constants for exothermic bimolecular reactions of all primary ions were obtained for reactant ion energies of 1.0 eV in the center of mass system. A number of endothermic reactions were observed. The dominant mode of reaction is that involving the transfer of an H^- species, giving $CH_3SiH_2^+$ product. It is concluded that, in general, the methyl group does not play an active role in the ionic chemistry of methylsilane, in that there appears to be no scrambling of H atoms bound to the carbon and silicon atoms, and in that H^- or H abstraction comes exclusively from the silicon end of the molecule. High pressure mass spectra, up to 0.3 torr, reveal a number of termolecular association reactions, the rate constants of which were measured. (auth)

12485 (COO-3416-17) ION–MOLECULE REACTIONS IN MONOSILANE–ETHYLENE MIXTURES. Mayer, T. M.; Lampe, F. W. (Pennsylvania State Univ., University Park (USA). Davey Lab.). 1974. Contract AT(11-1)-3416. 23p. Dep. NTIS $4.25.

The reactions of Si^+, SiH^+, SiH_2^+ and SiH_3^+ with C_2H_4 and the reactions of $C_2H_2^+$, $C_2H_3^+$ and $C_2H_4^+$ with SiH_4 were studied by tandem and high pressure mass spectrometry. Phenomenological rate constants were measured at a reactant ion kinetic energy of 1.4 eV in the laboratory system and reaction cross sections were studied over the range of 0.4 to 3.0 eV in the center-of-mass system. A persistent or "sticky" complex $SiC_2H_7^+$ is observed in collisions of SiH_3^+ with C_2H_4 with a cross section that decreases to zero at a center-of-mass energy of 1.3 eV. Formation of this complex in bimolecular reactions is confirmed in the high pressure mass spectrometric studies. It further is shown that at higher pressures the complex $SiC_2H_7^+$ successively adds two more molecules of C_2H_4 and it is suggested that all these adducts have the ultimate form of alkylsiliconium ions, namely $C_2H_5SiH_2^+$, $(C_2H_5)_2SiH^+$, and $(C_2H_5)_3Si^+$. (auth)

12486 (JUL-1091-FF) TWO-STATE APPROXIMATION FOR INELASTIC ATOMIC SCATTERING IN AN EXACTLY SOLUBLE MODEL. Dettmann, K.; Drepper, F.; Steinbeck, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Festkoerperforschung). Jul 1974. 60p. (In German). Dep. NTIS (U. S. Sales Only) $6.00.

Within the impact parameter treatment for inelastic atomic collisions the accuracy of the two-state approximations with atomic and molecular orbitals is estimated by comparison with an exactly soluble linear model. In this model with two δ-function-potentials of equal strength, suggested by G. Breit, the transition probabilities for elastic collisions and for charge exchange are solved exactly. These solutions show characteristic oscillations with varying impact velocity as were found experimentally, e.g., in proton–hydrogen collisions. Even in the low velocity limit the two state approximations reproduce these oscillations only qualitatively in position and amplitude. (auth)

12487 (LBL-3178) APPARATUS FOR INVESTIGATING LOW ENERGY ION-MOLECULE REACTIONS AND ITS APPLICATION TO THE REACTIVE SCATTERING OF N^+ BY H_2. Fair, J. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1974. Contract W-7405-eng-48. 103p. Dep. NTIS $8.25.

Thesis.

An apparatus was designed and constructed for measuring the scattering of ions from neutral molecules in a laboratory energy range of 6 to 50 eV. A beam of monoenergetic ions of a specified mass is generated by ionizing the parent neutral in an electron impact source and then passing the resulting ions through a magnetic momentum analyzer and electrostatic focusing system. The ion beam then passes through a collision cell which contains the neutral target molecules. The scattering ions are detected by a detection system which consists of a crossed electric and magnetic field velocity filter, a quadrupole mass filter and a magnetic electron multiplier. The primary ion source and collision cell are mounted on a rotatable table in a large vacuum chamber and the detection system is mounted on the side of the vacuum chamber. This arrangement allows intensity distributions as a function of angle, mass and velocity to be determined. The apparatus was used to study the reactive scattering of N^+ from H_2 to form NH^+. At laboratory energies above 20 eV the product intensity distribution peaked at approximately the position predicted from the spectator stripping model. As the relative energy was decreased the product intensity distribution became more symmetric around the center-of-mass and the peak intensity moved toward lower velocities until it coincided with the center-of-mass at a laboratory energy of 6.2 eV. This transition from a direct impulsive mechanism to a long-lived complex mechanism is explained by the characteristics of the electronic state correlation diagram. (auth)

12488 EFFECTIVE POTENTIAL STUDY OF ROTATIONALLY–VIBRATIONALLY INELASTIC COLLISIONS BETWEEN He AND H_2. Alexander, M.H. (Department of Chemistry, University of Maryland, College Park, Maryland 20742). J. Chem. Phys. 61: No. 12, 5167-5181 (15 Dec 1974).

Within the Rabitz effective potential formalism [J. Chem. Phys. 57, 1718 (1972)] we have carried out a three–dimensional, quantum mechanical study of He–H_2 collisions, concentrating on rotationally–vibrationally inelastic processes. We treat the H_2 molecule as a rotating Morse oscillator and use an interaction potential which is an analytic fit to the ab initio potential surface of Gordon and Secrest. Employing a modified version of the Gordon algorithm to solve the

close–coupled equations, we have performed a series of calculations involving the collision of He with both ortho– and para–hydrogen at collision energies ranging 1.2–2.0 eV. We have carefully investigated the convergence properties of the close–coupled expansion. We present cross sections for all relevant rotational processes associated with the $v=1 \rightarrow v=0$ collision–induced vibrational relaxation of the H_2 molecule. Our major conclusions are: (1) ~20 rotational–vibrational states must be included; (2) large changes in the molecular angular momentum may accompany vibrational relaxation; (3) the degree of resonance of a particular rotation–vibration process may play an important role in determining the probability of the transition; and (4) the total cross section for vibrational relaxation increases significantly with increasing molecular rotational angular momentum. (auth)

12489 MODEL FOR $H_2^+(v=0)$ –He COLLISIONS ABOVE 2 eV. North, G.R.; Harris, H.H.; Leventhal, J.J.; James, P.B. (University of Missouri at St. Louis, St. Louis, Missouri 63121). J. Chem. Phys. 61: No. 12, 5060-5065 (15 Dec 1974).

A classical model with no adjustable parameters employing Lennard–Jones type potentials is used to describe collision processes between H_2^+ (v=0) ions and He atoms at relative energies above 2 eV. The assumptions that justify such an approach are discussed as well as the possibility of additional simplifications. Model predictions for collision–induced dissociation and reactive scattering cross sections compare favorably with data from four laboratories. Predicted angular distributions of product HeH^+ and H_2^+ as well as vibrational and rotational energy partitioning for these products are also reported. (auth)

12490 QUANTUM MECHANICAL STREAMLINES. I. SQUARE POTENTIAL BARRIER. Hirschfelder, J.O.; Christoph, A.C. (Theoretical Chemistry Institute, University of Wisconsin at Madison, Madison, Wisconsin 53706); Palke, W.E. J. Chem. Phys. 61: No. 12, 5435-5455 (15 Dec 1974).

Exact numerical calculations are made for the scattering of quantum mechanical particles from a square two–dimensional potential barrier. This treatment is an exact analog of both frustrated total reflection of perpendicularly polarized light and the longitudinal Goos–Hänchen shift. Quantum mechanical streamlines (which are analogous to either classical mechanical trajectories or optical rays) are plotted. These streamlines are smooth, continuous, and have continuous first derivatives even through the classically forbidden region. The streamlines form quantized vortices surrounding each of the nodal points (which result from interference between the incident and reflected waves). Similar vortices occur in reactive collisions of $H + H_2$ (McCullough and Wyatt; Kuppermann, Adams, and Truhlar) and undoubtedly play an important role in molecular collision dynamics. The theory for these vortices is given in a companion paper. A comparison is given between our numerical calculations and the stationary phase approximation (SPA). Although our incident wave packet has a half–width of more than one de Broglie wavelength, in contrast to the SPA, which replaces the diffuse beams by rays with delta function profiles, the agreement was surprisingly good for both the Goos–Hänchen shifts and for the reflection coefficients. However, we found that the Goos–Hänchen shift for the transmitted beam is significantly smaller than for the reflected beam, although in the stationary phase approximation these two shifts are equal. Furthermore, we found that the scattering from the potential barrier has very little effect on the shape of the wave packets. The power series expansion of the incident Debye–Picht wave packet Ψ_I has an extremely small radius of convergence, whereas the power series for $\Psi_I^*\Psi_I$ has a radius of convergence of more than two de Broglie wavelengths. The imaginary velocity v_i is introduced into the Madelung–Landau–London hydrodynamical formulation of quantum mechanics. The corresponding imaginary streamlines will be considered in a forthcoming paper. The time–independent Schrödinger equation for real wavefunctions is reduced to solving the nonlinear first-order partial differential equation: $\hbar\nabla\cdot v_i = 2(E - V) + v_i^2$. Here, v_i is irrotational. This equation may lead to interesting new methods of solving the Schrödinger equation. It does lead to a generalization of the Prager–Hirschfelder perturbation scheme which invokes an electrostatic analogy. The philosophical implications of the hydrodynamical formulation of quantum mechanics are discussed. Penetration of a one–dimensional square potential barrier is used to demonstrate exactly how tunneling occurs by particles "riding over the barrier" à la Bohm. Cases are cited where quantum and classical mechanical motions are identical. (auth)

12491 CLASSICAL S–MATRIX CALCULATION FOR VIBRATIONALLY INELASTIC TRANSITIONS IN THREE DIMENSIONAL COLLISIONS OF Li^+ WITH H_2. Raczkowski, A.W.; Miller, W.H. (Department of Chemistry and Inorganic Materials Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). J. Chem. Phys. 61: No. 12, 5413-5420 (15 Dec 1974).

The "partially averaged" version of classical S–matrix theory is applied to three-dimensional collisions of Li^+ with H_2. For an initial collision energy of 0.684 eV cross sections for the vibrational deactivation of H_2 from the initial state $(n_1,j_1) = (1, 0)$ to final states (n_2,j_2), $n_2 = 0, j_2 = 0, 2, 4,...$ are computed and compared with the recent quantum mechanical coupled-channel calculations of Schaefer and Lester. The agreement is quite good, indicating that this approach is an accurate and practical way of describing these weak, "classically forbidden" processes which cannot be treated by ordinary classical trajectory methods. (auth)

12492 MOLECULAR SCATTERING EQUATIONS DERIVED FROM THE ROTATIONAL INVARIANCE OF WAVE OPERATORS. Hunter, L.W.; Snider, R.F. (Department of Chemistry, University of British Columbia, Vancouver 8, Canada). J. Chem. Phys. 61: No. 12, 5250-5256 (15 Dec 1974).

It is shown that the rotational invariance of the Møller wave operator can be used directly to derive the scattering equations of Curtiss and co–workers. An equation for the reactance matrix is also derived by the same method. (auth)

12493 THEORY OF DISTORTED–WAVE BORN APPROXIMATION FOR REACTIVE SCATTERING OF AN ATOM AND A DIATOMIC MOLECULE. Choi, B.H.; Tang, K.T. (Department of Physics, Pacific Lutheran University, Tacoma, Washington 98447). J. Chem. Phys. 61: No. 12, 5147-5157 (15 Dec 1974).

Theoretical analysis was made on the transition matrix of the distorted–wave Born approximation for reactive collisions of an atom and a diatomic molecule. Using an ordinary representation in which projections of the angular momentum of the initial and the final molecule are referred to the same fixed space axis, we separate out the angular variables describing the rigid rotation of the three–particle system and thus reduce the five–dimensional integral in the transition matrix to a three–dimensional integral. The significance of the present formulation is illustrated by actual calculations of the reactive scattering of the (H, H_2) system. For $0 \rightarrow 0$ rotational transition, early results are reproduced with less than 1% of the computer time previously used. For $0 \rightarrow 1$ rotational transition, present results, which are also readily obtained, are compared with those of close–coupling calculation. The reliability of the adiabatic distorted–wave model for reactive scattering and possible impacts of the present formulation on kinetics are discussed. (auth)

12494 VIBRATION–ROTATION INELASTICITY IN $He-H_2$. Rabitz, H.; Zarur, G. (Princeton University, Department of Chemistry, Princeton, New Jersey 08540). J. Chem. Phys. 61: No. 12, 5076-5084 (15 Dec 1974).

Vibration–rotation inelasticity in $He-H_2$ is studied up to total energy 1.5 eV. This extends the previous lower energy pure rotational studies with the effective potential method. Comparison is made with breathing sphere calculations, and the corresponding vibration–rotation differential and total cross sections are similar. However, it is shown that there are many other nonbreathing sphere-type vibration–rotation cross sections of comparable magnitude. The competitive roles of coupling and energetic resonance effects are quite apparent in the cross sections. The differential and total cross sections are examined for general characteristic behavior. An analysis is presented of the energy dependence of the cross sections. Finally, comments on general effective Hamiltonian methods are included. (auth)

12495 INELASTIC SCATTERING IN ATOM–DIATOMIC MOLECULE COLLISIONS. I. ROTATIONAL TRANSITIONS IN THE SUDDEN APPROXIMATION. Stallcop, J.R. (Ames Research Center, NASA, Moffett Field, California 94035). J. Chem. Phys. 61: No. 12, 5085-5097 (15 Dec 1974).

The impact parameter method and the sudden approximation are applied to determine the total probability of inelastic rotational transitions arising from a collision of an atom and a homonuclear diatomic molecule at large impact parameters. An analytical approximation to this probability is found for conditions where the electron exchange or overlap forces dominate the scattering. An approximate upper bound to the range of impact parameters for which rotational scattering can be important is determined. In addition, an estimate of the total inelastic cross section is found at conditions for which a statistical model describes the scattering well. The results of this analysis are applied to $Ar-O_2$ collisions and may be readily applied to other combinations of atoms and molecules. (auth)

12496 QUANTIZED VORTICES AROUND WAVEFUNCTIONS. II. Hirschfelder, J.O. (Theoretical Chemistry Institute, University of Wisconsin, Madison, Wisconsin 53706); Goebel, C.J.; Bruch, L.W. J. Chem. Phys. 61: No. 12, 5456-5459 (15 Dec 1974).

Quantized vortices can occur around nodes of wavefunctions. This fact, discovered by Dirac (1931) but little noted since, is rederived here and examples are discussed. The derivation depends only on the wavefunction being single valued and continuous. Since the derivation does not depend upon the dynamical equations, the quantized vortices are expected to occur for many types of waves (i.e., electromagnetic, acoustic, etc.). Such vortices have appeared in the calculations (McCullough and Wyatt, Kuppermann) of the $H + H_2$ molecular collisions and play a role in the chemical kinetics. In a companion paper, it is shown that quantized vortices occur when optical waves are internally reflected from the face of a prism or particle beams are reflected from potential energy barriers. (auth)

12497 SEMICLASSICAL EXTENSION OF LEVINSON'S THEOREM TO A PARTICLE INTERACTING WITH A HARMONIC OSCILLATOR. Lin, Y.; George, T.F. (Department of Chemistry, The University of Rochester, Rochester, New York 14627). J. Chem. Phys. 61: No. 12, 5396-5399 (15 Dec 1974).

A semiclassical extension of Levinson's theorem to a model three-body system is presented. The system chosen is a particle interacting with a harmonic oscillator for collinear configurations. The theorem predicts the number N of three-body bound states that a potential energy surface can support, and this number is calculated for a set of surfaces for this model collinear system. The calculation involves the extrapolation of the S matrix to zero collision energy, where S matrix elements needed in the extrapolation are found in the classical limit. For comparison, N is also calculated in a purely classical fashion from the multidimensional phase space volume integral. The results from the semiclassical and purely classical calculations are in fairly good agreement. (auth)

12498 DISORIENTATION OF Na($3^2P_{\frac{1}{2}}$) ATOMS, INDUCED IN COLLISIONS WITH NOBLE GASES. Niewiecka, B.; Skalinski, T.; Krause, L. (Univ. of Windsor, Ont.). Can. J. Phys.; 52: No. 20, 1956-1960(15 Oct 1974).

The cross sections for disorientation of $3^2P_{\frac{1}{2}}$ sodium atoms, induced in collisions with noble gas atoms, were determined by following the depolarization of Na-D_1 resonance fluorescence in relation to noble gas pressure. Sodium vapor at low density, mixed with a noble gas in a fluorescence cell, was irradiated with circularly polarized D_1 resonance radiation and the resulting D_1 resonance fluorescence, observed in an approximately backward direction, was analyzed with respect to circular polarization. The variation of the degree of polarization with gas pressure was interpreted on the basis of a "J randomization" model for the collisions, and yielded the following disorientation cross sections which are appropriately corrected for effects due to nuclear spin. Na-He: 28.1 ± 4.0 Å^2; Na-Ne: 27.8 ± 4.0 Å^2; Na-Ar: 57.0 ± 8.0 Å^2; Na-Kr: 78.0 ± 10 Å^2; Na-Xe: 87.0 ± 13 Å^2. (auth)

12499 ELECTRON-IMPACT EXCITATION CROSS-SECTIONS FOR COMPLEX IONS. I. THEORY FOR IONS WITH ONE AND TWO VALENCE ELECTRONS. Sampson, D.H. (Department of Astronomy, The Pennsylvania State University, University Park). Astrophys. J. Suppl. Ser. 28: No. 263, 309-321 (Sept 1974).

Expressions are derived for the cross-sections for excitation of complex ions by electron impact. The results are expressed in terms of the R-matrix elements for hydrogenic ions with $Z=\infty$ and are exact, apart from relativistic effects, in the limit $Z\to\infty$. For most of the transitions of interest in ions with four or less bound electrons the cross-sections reduce to a very simple form. The method allows one to obtain cross-section values for complex ions with very little computational effort, since a large number of data for hydrogenic ions with $Z=\infty$ exist. (auth)

12500 ELECTRON-IMPACT EXCITATION CROSS-SECTIONS FOR COMPLEX IONS. II. APPLICATION TO THE ISOELECTRONIC SERIES OF HELIUM AND OTHER LIGHT ELEMENTS. Sampson, D.H.; Parks, A.D. (Department of Astronomy, Pennsylvania State University, University Park). Astrophys. J. Suppl. Ser. 28: No. 263, 323-334 (Sept 1974).

Numerical results are obtained for collision strengths for transitions involving principal quantum numbers $n \geq 3$ induced by electron impact on highly ionized atoms with four or less bound electrons. The results are fitted to analytic expressions which are readily integrated over a Maxwellian velocity distribution to give collision rates. Comparison is made with results available by other methods. Unless Z is very large so that relativistic corrections are of great importance, the approach used improves with increase in Z. It appears for the most part to be accurate to within 40 percent for $Z/N \geq 3$, where N is the number of bound electrons per ion. (auth)

12501 NEAR-THRESHOLD EXCITATION OF METASTABLE HELIUM BY ELECTRON IMPACT AS STUDIED BY THE TIME-OF-FLIGHT METHOD. Heppner, R.A.; Zorn, J.C. (Randall Laboratory of Physics, University of Michigan, Ann Arbor, Michigan 48104). Phys. Rev. Lett. 33: No. 22, 1321-1324 (25 Nov 1974).

A time-of-flight method is used to measure the distribution in speed and angle of the metastable atoms produced when ground-state helium atoms are excited by electron impact at near-threshold energies. The results are compared to predictions based on both theoretical and experimental determinations of the differential cross section, and it appears that there are significant discrepancies between the time-of-flight data and the predictions based on available theoretical cross-section calculations. (auth)

12502 ANGULAR DISTRIBUTION OF O$^-$ FROM DISSOCIATIVE ELECTRON ATTACHMENT TO NO. Van Brunt, R.J. (University of Virginia, Charlottesville, Virginia 22901); Kieffer, L.J. Phys. Rev. A 10: No. 5, 1633-1637 (Nov 1974).

The electron energy dependence of the angular distribution of O$^-$ produced by dissociative electron attachment to NO has been measured in the energy range 8.0-11.0 eV. The distributions are observed to be anisotropic and of a form that is nearly $\sin^2\theta$ at all energies. Deviations from a $\sin^2\theta$ dependence are discussed in terms of the relative contributions of different partial waves to the differential cross section. The results indicate that the final repulsive negative-ion resonances involved must be either Σ or Δ states. (auth)

12503 HARTREE-FOCK GENERALIZED OSCILLATOR STRENGTHS FOR ELECTRON IMPACT EXCITATION OF THE $2\,^1P$ STATE OF HELIUM. Truhlar, D.G. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455); Cartwright, D.C. Phys. Rev. A 10: No. 5, 1908-1910 (Nov 1974).

Analytic Hartree-Fock generalized oscillator strengths for the 1^1S-2^1P transition in He are presented and compared with values calculated by other methods. (auth)

12504 SCATTERING OF ELECTRONS FROM H_2 NEAR ROTATIONAL THRESHOLDS. Chang, E.S. (Department of Physics and Astronomy, University of Massachusetts, Amherst, Massachusetts 01002). Phys. Rev. A 10: No. 5, 1911-1912 (Nov 1974).

A previous theory for rotational excitation of molecules is modified to include the effect of the anisotropic polarization potential in addition to the quadrupole potential. This refinement results in better agreement with some new experimental data. (auth)

12505 ORBIT-INTEGRAL CORRECTIONS TO THE LINDHARD ATOMIC STOPPING POWER FOR CLASSICALLY SCATTERED HEAVY ATOMS. Latta, B.M.; Scanlon, P.J. (Department of Physics, Queen's University, Kingston, Ontario, Canada). Phys. Rev. A 10: No. 5, 1638-1645 (Nov 1974).

The differences between atom-atom differential scattering cross sections calculated by integration of the classical orbit equations, and those obtained from the universal curve of Lindhard, have been used to calculate corrections to the specific nuclear energy loss, $(d\epsilon/d\rho)_n$, as a function of the reduced energy ϵ. The calculations have been performed both for the Thomas-Fermi (TF) interaction potential, which appears to be appropriate for gas scatterers, and for a finite-range Thomas-Fermi potential which may be more appropriate for scattering centers in a solid. For values of $\epsilon > 0.1$ the correction factor can be as small as 0.9. At lower values of ϵ the correction factor can be greater than unity for the infinite-range TF potential, but continues to decrease for all the finite-range calculations. (auth)

12506 DETERMINATION OF CLOSED FORM EXPRESSIONS FOR PERTURBATION THEORY CORRECTIONS TO WAVE FUNCTIONS OF BOUND STATES WITH THE AID OF THE STURM FUNCTION EXPANSION. Sherstyuk, A. I. Teor. Mat. Fiz.; 21; No. 2, 224-232(Nov 1974). (In Russian).

The closed form expressions for the first- and second-order perturbation theory corrections to the wave functions of an arbitrary bound state of the electron in Coulomb field with the central-symmetric perturbation potential are obtained by means of summing up the expansions of the corrections in the complete set of eigenfunctions of the Sturm-Liouville operator which possesses only discrete spectrum. (auth)

12507 INVESTIGATION OF SHORTWAVE RADIATION EMITTED IN SLOW COLLISIONS BETWEEN Na^+ IONS AND Ne ATOMS. Belik, V. P.; Bobashev, S. V.; Dmitriev, S. P. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1674-1681(Nov 1974). (In Russian).

Radiation in the 200 to 1000 Å wavelength region emitted in collisions between 0.2 to 10 keV Na^+ ions and Ne atoms is investigated. Excitation functions are obtained for the most intense spectral lines and the absolute values of the excitation cross sections for the lines are estimated. The λ407.1 Å Ne II line is found to be the most intensely excited. Various processes which may lead to excitation of the line are discussed. It is demonstrated that in phase interference of excited states of the (Na^+Ne) quasimolecule a certain isolated group of quasimolecular states of the system is involved. (auth)

12508 ELECTROMAGNETIC RADIATION DUE TO SYMMETRIC ION-ATOM COLLISIONS. Drukarev, G.F.; Mikhailov, A.A. Opt. Spectrosc. (USSR) 37: No. 2, 220-221 (Aug 1974).

Electromagnetic radiation accompanying process of resonant charge exchange from H to H^+ is considered. (auth)

12509 PENNING EFFECT IN COLLISION WITH AN EXCITED HELIUM ION. 2. Kvlividze, V.A.; Laktionov, N.V.; Svotin, P.A. Opt. Spectrosc. (USSR) 37: No. 3, 344-345 (Sept 1974).

We present calculations for the Penning effect in collisions of helium ions with atoms of helium, neon, argon, krypton, and xenon. The energy range 0.5-30 eV is considered. (AIP)

12510 FORM FACTOR PROGRAM FOR RAYLEIGH SCATTERING OF GAMMA RAYS BY BOUND ELECTRONS. Smend, F.; Schumacher, M. (Goettingen Univ. (F. R. Germany). 2.

Physikalisches Inst.). Comput. Phys. Commun.; 7: No. 7, 389-391(Jul 1974).

The program performs calculations of the form factors and corrected form factors for the elastic scattering of gamma rays by the electrons of a complete subshell of an atom on the basis of Dirac one-electron wave functions. Closed form expressions for the form factors and corrected form factors are used. (auth)

12511 QUASIMOLECULAR KX-RAY EXCITATION BY BOMBARDING As, Zr, Nb, Mo AND Rh TARGETS WITH Nb IONS. Gippner, P.; Kaun, K.-H.; Sodan, H.; Stary, F.; Schulze, W.; Tretyakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). Phys. Lett., B; 52: No. 2, 183-186 (30 Sep 1974).

By bombarding various targets with 6.5 and 40 MeV Nb ions continuous x-ray distributions were obtained, which range up to the Kx-ray energies of quasi-atoms with $Z = Z_1 + Z_2$. The high energy parts of these continua are interpreted as Kx-radiation of quasimolecules transiently formed during the adiabatic heavy-ion atomic collisions. (auth)

12512 ALMOST-ADIABATIC COLLISIONS OF QUANTUM SYSTEMS. Schulte, A. M.; Verhaar, B. J. (Technische Hogeschool Eindhoven (Netherlands)). Nucl. Phys., A; 232: No. 1, 215-229(28 Oct 1974).

Expressions are derived for corrections resulting from a small variation of the "slow" internal degrees of freedom during an almost-adiabatic quantum collision. First-order nonadiabatic contributions to the scattering wave function and scattering T-matrix element are derived making use of (a) Wronskian surface terms, and (b) converging factors. Advantages of method (a) are indicated. Modifications of the expressions necessary to include a possible projectile intrinsic spin are described. A one-dimensional model illustrating the range of validity of the adiabatic approximation is presented. (auth)

12513 ON THE COLLISION OPERATOR IN AN EXACTLY SOLUBLE MODEL. Mareschal, M.; Grecos, A. P. (Brussels Univ. (Belgium). Faculte des Sciences). Physica; 76: No. 2, 321-344(1 Sep 1974).

The properties of the collision operator, as defined by the Brussels school, are studied for systems whose hamiltonian is a cyclic matrix (finite case) or a Laurent matrix (infinite case). Explicit calculations in particular examples illustrate the difference in the behaviour of this operator when long-range interactions are present. (auth)

Atomic Theory

12514 UNIT TENSORS IN THE RELATIVISTIC MATRIX ELEMENTS OF THE ENERGY OPERATORS. Kychkin, I. S.; Rudzikas, Z. B. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 31-43(1974). (In Russian).

The unit tensors are defined in the case of the relativistic wave functions of the jj-coupling scheme. The matrix elements of the scalar product of the tensorial operators, consisting of these unit tensors, are considered in the case of the subshell nlj^N. The formulas for the matrix elements of the electrostatic and magnetic interaction operators (including retardation effect), expressed in terms of these unit operators, are presented. It is shown that their angular parts do not depend on the orbital quantum numbers in this case. The relations between the matrix elements of almost and partially filled subshells are given. The case of a closed subshell is considered as well. (auth)

12515 RELATIVISTIC MATRIX ELEMENTS OF THE ENERGY OPERATOR IN THE CASE OF TWO SUBSHELLS OF ATOMIC ELECTRONS. Kychkin, I. S.; Rudzikas, Z. B. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 45-56(1974). (In Russian).

The expressions for two-electron matrix elements of the relativistic atomic Hamiltonian are obtained when relativistic wave functions of coupled momenta are used. The results obtained are generalized for the case of two subshells $n_1l_1j_1^{N_1}$ $n_2l_2j_2^{N_2}$. These matrix elements are expressed in terms of one-electron coefficients of fractional parentage and the corresponding formulas for two-electron configurations. More convenient expressions of these matrix elements are found when using matrix elements of the unit operators. A special case of the filled subshell is considered as well as the relations between matrix elements of almost and partially filled subshells. (auth)

12516 EFFECT OF ORBIT-ORBIT AND CONTACT INTERACTIONS ON ATOMIC SPECTRA. Vizbaraite, Ya. I.; Kanyauskas, Yu. M.; Rudzikas, Z. B. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 57-66(1974). (In Russian).

The relativistic corrections to the electrostatic energy of atoms (the orbit-orbit and the contact interactions) are considered. The isoelectronic sequence $3d^3$ of ScI-NiVIII was studied. It is shown that both corrections must be taken into account. In the case of the rare earth elements (the configuration $4f^N6s^2$) the examples are presented, which illustrate that these corrections do change the positions of some terms. The corrections must precede the diagonalization of the energy matrix. (auth)

12517 APPLICATION OF THE NON-ORTHOGONAL RADIAL ORBITALS FOR THE INVESTIGATION OF DIPOLE TRANSITION $1s^22s2p^{N+1}-1s^22s^22p^N$. Kuplyauskis, Z. N.; Lazauskas, V. M. (Vilnyus State Univ., USSR). Liet. Fiz. Rinkinys; 14: No. 1, 67-72(1974). (In Russian).

The method of the application of nonorthogonal radial orbitals for the calculation of matrix elements of the dipole transition operator was considered. The oscillator strengths for atoms, single- and double-ions were calculated. The results show that the nonorthogonal radial orbitals give the oscillator strengths better than the orthogonal ones. (auth)

12518 EFFECT OF SCREENING AND COMPRESSION ON ENERGY LEVELS OF ATOMS IN PLASMA. Savukinas, A. Yu.; Chizhyunas, A. R. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 73-82(1974). (In Russian).

The energy level shift and splitting of the hydrogen atom and hydrogenic ions in plasma are considered. The static screened Coulomb potential (Debye-Hückel potential) and the cut-off Coulomb potential as well as the compressed atom model were used. The boundary conditions $R(r_0) = 0$ as well as $R'(r = r_0) = 0$ were assumed for the radial orbitals of the compressed atoms. The expression for the energy in the cases of small screening and the low compression is obtained. The values of critical screening and critical compression lengths are given. (auth)

12519 RELATIVISTIC CONSIDERATION OF THE SUBSHELL OF THE EQUIVALENT ELECTRONS nlj^N. Kychkin, I. S.; Rudzinas, Z. B. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 19-30(1974). (In Russian).

A method of obtaining the relativistic antisymmetrized wave function in the case of an equivalent electron subshell is described. The treatment is carried out in a jj coupling scheme. The matrix elements of the many electron relativistic Hamiltonian consisting of the sum of the Dirac Hamiltonians and the interelectronic interaction operators, which include electrostatic and magnetic terms and retardation effects, are considered. Using the method of the irreducible tensorial operators and the fractional parentage coefficients, the expressions for these matrix elements are given in the case of one unfilled subshell nlj^N configuration. (auth)

12520 CANONICAL GROUP TREATMENT OF ATOMIC SPIN AND ORBIT DEPENDENT OPERATORS IN MULTIPLE ELECTRON CONFIGURATIONS. Patterson, C. W. Los Angeles; Univ. of Southern California (1974). University Microfilms Order No. 74-26,043.

Thesis (Ph.D.).

A canonical irreducible basis of U(n) and SU(n) is constructed explicitly from a canonically symmetrized pth-rank, n-dimensional tensor space for a description of multiple electron configurations. Canonical SU(21 + 1) bases are used for total orbital angular momentum eigenstates and canonical SU(2) bases are used for total spin angular momentum eigenstates in (1) P atomic configurations. Closed form expressions for subduction coefficients are derived for the Slater determinant in terms of direct products of SU(21 + 1) and SU(2) canonical bases. The subduction formulas and some additional techniques are reduced to simple algorithms for calculating matrix elements of spin and orbit dependent operators. Examples of this procedure for the spin-orbit operator are shown. (Diss. Abstr. Int., B)

12521 ROOTHAAN-HARTREE-FOCK ATOMIC WAVEFUNCTIONS. Basis Functions and Their Coefficients for Ground and Certain Excited States of Neutral and Ionized Atoms, $Z \leq 54$. Clementi, E.; Roetti, C. (IBM Research Lab., San Jose, CA). At. Data Nucl. Data Tables; 14: No. 3-4, 177-478(1974).

Tables are presented of the exponents of the basis functions and the coefficients to be used in analytic wave functions expanded in the Roothaan-Hartree-Fock method according to which $\phi_{i\lambda\alpha} = \Sigma\chi_{p\lambda\alpha}C_{i\lambda p}$, where the χ's are functions of the form $Nr^{n-1}e^{-\zeta r}Y(\theta,\phi)$. Values of C and ζ are tabulated for $Z \leq 54$ for atoms, positive ions, and isoelectronic series. (auth)

12522 GROUP THEORETICAL APPROACH TO THE CONFIGURATION INTERACTION AND PERTURBATION THEORY CALCULATIONS FOR ATOMIC AND MOLECULAR SYSTEMS. Paldus, J. (Quantum Theory Group, Department of Applied Mathematics, Faculty of Mathematics and Department of

Chemistry, Faculty of Science, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1). J. Chem. Phys. 61: No. 12, 5321-5330 (15 Dec 1974).

A formalism for an efficient generation of spin–symmetry-adapted configuration interaction (CI) matrices of the N–electron atomic or molecular systems, described by nonrelativistic spin–independent Hamiltonians, is presented. The Gelfand and Tsetlin canonical basis for the finite-dimensional irreducible representations of the unitary groups is used as an N–electron CI basis. A simplified Gelfand–type pattern pertaining to the N–electron problem is introduced, which considerably simplifies the canonical basis generation and, more importantly, the calculation of representation matrices of the (infinitesimal) generators of the pertinent unitary group in this basis. The calculation of the CI matrices for the above-mentioned systems is then straighforward, since any particle number-conserving operator may be written as a sum of n–degree forms in the unitary group generators. The computation of CI matrices for various Hamiltonians as well as the problems of the space–symmetry adaptation of the Gelfand–Tsetlin basis and of limited CI calculations are briefly discussed. (auth)

12523 TWO-WAVE INTERACTION IN A RESONANCE MEDIUM. Kanetsyan, E. G.; Shakhnazaryan, N. V. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 4, 335-337(1974). (In Russian).

Multiphoton effects in the interaction of two intense monochromatic waves with a two-level atom are considered. Along with the Rayleigh and three-photon process cross section, the cross sections of some multiphoton processes due to the parametric transfer of energy from one wave to the other are derived. (auth)

12524 THOMAS–FERMI AND THOMAS–FERMIC–DIRAC CALCULATIONS FOR ATOMS IN A VERY STRONG MAGNETIC FIELD. Banerjee, B. (Tata Institute of Fundamental Research, Bombay, India); Constantinescu, D.H.; Rehák, P. Phys. Rev. D 10: No. 8, 2384-2395 (15 Oct 1974).

A statistical model for atoms in a very strong magnetic field ($10^{12}-10^{14}$ G) may be built, starting from the assumption that the Coulomb motion of the atomic electrons is adiabatically slow with respect to their magnetic motion. Within this framework, the binding energies and radii, as well as the ionization energies of singly and doubly ionized atoms, are computed for atomic numbers $5 \leqslant Z \leqslant 100$ in the Thomas–Fermi case, and for $5 \leqslant Z \leqslant 70$ in the Thomas–Fermi–Dirac case. Possible astrophysical implications may concern the emission of electrons and ions from the surface of pulsars, the abundances of the elements in the cosmic radiation, and the properties of the condensed matter forming the outer crust of magnetic neutron stars. (auth)

12525 ERRORS IN EIGENVALUES CALCULATED BY THE NUMEROV-COOLEY METHOD. Guest, P. G. (Sydney Univ. (Australia). School of Physics). Comput. Phys. Commun.; 8: No. 1, 31-34(Aug 1974).

Formulas are established for the errors in the eigenvalues obtained by using standard Numerov integration methods. These error estimates can be used to derive more accurate eigenvalues without the necessity of increasing the number of iteration steps. (auth)

12526 A METHOD FOR CALCULATING THE ALGEBRA OF MATRIX ELEMENTS FOR PHOTOIONIZATION AND LINE RADIATION. Jones, M. (University Coll., London (UK)). Comput. Phys. Commun.; 7: No. 7, 353-367(Jul 1974).

A detailed algebraic formulation of the matrix elements required in the calculation of photoionization cross sections and transition probabilities for line radiation is given. The formulation is based upon the Slater state expansion method: it is consistent with that developed by Eissner for calculating the angular coefficients required in setting up the coupled integro-differential equations of electron-atom collision theory. The formulation was implemented in a general-purpose automatic computer program. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

12527 SINGULARITIES ON THE LIGHT CYLINDER IN RELATIVISTIC IDEAL MAGNETOHYDRODYNAMICS. Asano, N. (Utsunomiya Univ., Japan); Ikuta, T.; Taniuti, T. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1273-1275(Apr 1974).

12528 CONDUCTING GAS FLOW IN AN ANNULAR CHANNEL IN THE PRESENCE OF EXTERNAL ELECTRIC AND MAGNETIC FIELDS. Lun'kin, Yu. P.; Fursenko, A. A.; Shmidt, A. A. Magn. Gidrodin.; No. 3, 67-72(1974). (In Russian).

The flow being established of an ionized gas in external electric and magnetic fields in a coaxial channel was studied. The partially magnetized plasma was examined. The non-equilibrium ionization reaction was taken into consideration. The system of equations extracted made it possible to examine the motion of all components of the plasma. (tr-auth)

12529 EFFECT OF AN ELECTRIC CURRENT ON THE VELOCITY FIELD AROUND A NON-CONDUCTING DROP AND ON ITS DISSOLUTION IN A CONDUCTING LIQUID. Oreper, G. M. Magn. Gidrodin.; No. 3, 52-56(1974). (In Russian).

The problem on the determination of the effect of an electric current on the velocity field surrounding a non-conducting non-deformed drop with a current-carrying fluid flowing past it was solved by the method of joined asymptotic resolution. By means of the rate field found, the effect of the electric current on the process of mass exchange of the drop with the surrounding fluid was examined. (tr-auth)

12530 CAVITATION IN MERCURY FLOW IN A TRANSVERSE MAGNETIC FIELD. Kamiyama, S.; Yamazaki, T. Magn. Gidrodin.; No. 3, 41-44(1974). (In Russian).

Experiments with two Venturi tubes in order to clarify the effect of a transverse magnetic field on the appearance of cavitation in mercury flows were described. In order to explain the observed phenomenon, the change in pressure in some points of the tube was measured. The analysis of the results obtained indicated that the change, by the magnetic field, of the conditions for the onset of cavitation is connected with its effect on the character of the flow in the output from the narrow part of the tube. (tr-auth)

12531 SHOCK WAVES IN RELATIVISTIC ANISOTROPIC MAGNETOHYDRODYNAMICS. Cissoko, M. Compt. Rend., Ser. A; 278: No. 18, 1233-1236(29 Apr 1974). (In French).

The shock wave propagation in a relativistic anisotropic fluid without energy dissipation and with an infinite conductibility is investigated. The complete shock equation system verified by a polytropic anisotropic fluid is derived. (FR)

12532 SOME PROBLEMS OF DOUBLE WAVES IN MAGNETOHYDRODYNAMICS. Zajaczkowski, W. (Instytut Podstawowych Problemow Techniki, Warsaw). Arch. Mech. Stosow.; 26: No. 2, 211-220(1974).

It was shown that an interaction process of two magnetoacoustic simple waves for the MHD system can be described always by a system of Riemann invariants. The hodograph of this interaction process, being the solution of the MHD equations, is determined by a partial differential equation of second order for a density fluid function with independent variables as components of the fluid velocity. In the case of the cylindrical hodograph this problem is reduced to analysis of the ordinary differential equations. The possibility of the linear interaction process of two magnetoacoustic simple waves was presented. (IAA)

12533 THEORETICAL AND EXPERIMENTAL STUDY OF THE SLOW MOTION OF AN ELECTROCONDUCTING FLUID, INSIDE AN INSULATING SPHERICAL SHELL, DRIVEN BY THE UNIFORM ROTATION OF A CAP, IN AN AXIAL MAGNETIC FIELD. Pizard, P.; Vives, C. (Centre Universitaire, d'Avignon, France). Delft Progr. Rep., Ser. B; 278: No. 23, 1005-1008 (5 Jun 1974). (In French).

The kinetic equation and the induced magnetic field equation are solved. The results of the numerical exploitation of the solution of the kinetic equation are confirmed by experiment. The application of an uniform and axial magnetic induction field is shown to involve a braking or acceleration effect, according to the occupied zones. (FR)

12534 INITIAL VALUE METHOD FOR THE SOLUTION OF THE MAGNETOHYDRODYNAMIC FLOW PAST A FLAT PLATE. Rathna, B. R. (Mahant's Layout, Bangalore, India). Acta Phys. Acad. Sci. Hung.; 36: No. 3, 287-296(30 Sep 1974).

An initial value method has been used to obtain the solution of the boundary layer equations governing the flow of an electrically conducting liquid past a fixed semi-infinite unmagnetized but conducting plate under the influence of a uniform magnetic field acting parallel to the plate. The two-point boundary value problem has been reduced to an initial value problem by using the theory of transformation groups and then integrated with the help of a fourth order Runge–Kutta–Gill algorithm. The main advantage of the method is that the trial and error process usually required for the solution of the two-point boundary value problem is completely eliminated. The results obtained are in very close agreement with the corresponding results of the two-point boundary value problem and the computer time required for the solution is much less compared to that for other numerical methods. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

12535 LACK OF LOW-DENSITY COSMIC-RAY TRACKS. Clark, A.F.; Finn, H.F.; Hansen, N.E.; Smith, D.E. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. D 10: No. 9, 2721-2734 (1 Nov 1974).

A diligent search for low-density (quark) tracks in cloud-chamber pictures of cosmic rays has been negative. The flux of fractionally charged particles in extensive air showers (EAS) is estimated, at a 90% confidence level, to be less than 2×10^{-11} cm^{-2} sr^{-1} sec^{-1} for particles having a charge of 2e/3, less than 8×10^{-11} for 1e/3, less than 7×10^{-10} for 1e/4, and less than 1×10^{-7} for 1e/6, where e is the charge on an electron. The chambers were triggered by EAS about once an hour; the ions were allowed to diffuse so that individual droplets could be counted; the positive- and negative-ion colomns were separated in an electric field so that the timing of the tracks was measured and the proper operation of the cloud chamber monitored. Individual droplets were counted "by hand" (looking in microscopes) and by automated methods. Artificial low-density tracks were superimposed on regular pictures to train the scanners and to measure their efficiency. 200000 stereo picture pairs containing 10^6 cosmic-ray tracks have been scanned for quark tracks; none has been found. (auth)

Electromagnetic

Refer also to abstracts 11403, 12460, and 12589.

12536 (DESY-74/42) DO RECENT e^+e^- ANNIHILATION DATA IMPLY VIOLATIONS OF SCALING IN DEEP INELASTIC ELECTRON SCATTERING? Iwai, S.; Schildknecht, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Sep 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

It is conjectured that there is breaking of scaling in the large ω region in deep inelastic electron scattering as a reflection of the approximate constancy of $\sigma(e^+e^- \to \text{hadrons})$ observed from about 3.5 to 5 GeV cm energy. (auth)

12537 (JINR-P1-8199) CHARACTERISTICS OF THE LONGITUDINAL DEVELOPMENT OF THE ELECTRON-PHOTON SHOWERS INDUCED BY THE γ-QUANTA OF 30, 50, 70, 100, AND 120 MeV IN LIQUID XENON. Okhrimenko, L. S.; Slovinskii, B.; Strugal'skii, Z. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The results are presented of investigations of the development lengths, the total ranges of shower electrons and corresponding fluctuations in the showers induced by the γ-quanta of 30, 50, 70, 100 and 120 MeV in liquid xenon. The scaling property is revealed in the integral cascade curves and in a studied dependence of fluctuations on the part of the shower electron total range. (auth)

12538 e^+e^- COLLIDING BEAMS PHYSICS. Paoluzi, L. (Univ., Rome). Acta Phys. Pol., B5: No. 6, 751-797(1974).

The aim of these lectures is to discuss the present experimental situation of e^+e^- colliding beams physics. (auth)

12539 REVIEW OF EXPERIMENTAL RESULTS IN ELECTROPRODUCTION. Berkelman, K. (Cornell Univ., Ithaca, NY). Acta Phys. Pol., B5: No. 6, 751-797(1974).

The available data on hadronic final states in high energy electron-nucleon scattering are summarized, with emphasis on the most recent experiments in the deep inelastic scaling region. (auth)

12540 DECAY WIDTH OF THE NEUTRAL π MESON. Browman, A.; DeWire, J.; Gittelman, B.; Hanson, K.M.; Larson, D.; Loh, E. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14850); Lewis, R. Phys. Rev. Lett. 33: No. 23, 1400-1403 (2 Dec 1974).

The cross section for the photoproduction of π^0 mesons from complex nuclei at small angles has been measured at incident bremsstrahlung energies of 4.4 and 6.6 GeV. The data are fitted by a cross section calculated from a sum of Primakoff and nuclear-production amplitudes. A total decay width for the π^0 meson of 8.02 ± 0.42 eV is obtained from the magnitude of the Primakoff amplitude. (auth)

12541 ELASTIC SCATTERING OF LOW ENERGY PHOTONS BY PROTONS, AND ELECTROMAGNETIC POLARIZABILITY OF THE PROTON. Baranov, P. S.; Buinov, G. M.; Godin, V. G.; Kuznetsova, V. A.; Petrun'kin, V. A.; Tatarinskaya, L. S.; Shirchenko, V. S.; Shtarkov, L. N.; Yurchenko, V. V.; Yanulis, Yu. P. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 398-399(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 777-780(20 Jun 1974).

The differential cross section for elastic scattering of photons by protons at angles 90° and 150° were measured in the energy interval from 70 to 110 MeV. The experimental data were used to determine the coefficients of the electric and magnetic polarizabilities of the proton, $\bar{\alpha} = (10.7 \pm 1.1) \times 10^{-43}$ cm^3 and $\bar{\beta} = (-0.7 \pm 1.6) \times 10^{-43}$ cm^3, respectively. (auth)

12542 SEARCH FOR $\Delta I=2$ ELECTROMAGNETIC CURRENTS IN PION PHOTOPRODUCTION. Clifft, R.W.; Gabathuler, E.; Littenberg, L.S.; Marshall, R.; Rock, S.E.; Thompson, J.C.; Ward, D.L. (Daresbury Laboratory, Daresbury, near Warrington, Lancastershire, England); Brookes, G.R. Phys. Rev. Lett. 33: No. 25, 1500-1503 (16 Dec 1974).

Differential cross sections for the reactions $\gamma p \to \pi^0 p, \pi^+ n$ and $\gamma n \to \pi^- p, \pi^0 n$ were measured in a single experiment using tagged photons in the energy region 240-450 MeV incident on $^1H_2$ and $^2H_2$ targets. Results of the measurements of the ratios $\pi^0 n/\pi^0 p$ and $\pi^- p/\pi^+ n$ are presented. The ratio of isotensor to isovector amplitude is found to be 0.00 ± 0.02. (auth)

12543 MEASUREMENT OF ASYMMETRIES IN POLARIZED $\gamma N \to \pi N$, WITH E_γ FROM 600 TO 900 MeV. Knies, G.; Oberlack, H.; Rittenberg, A.; Rosenfeld, A.H. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Bogdanski, M.; Smadja, G. Phys. Rev. D 10: No. 9, 2778-2784 (1 Nov 1974).

We report on the measurement of asymmetries in the single-pion photoproduction reactions $\gamma p \to n\pi^+$, $\gamma p \to p\pi^0$, and $\gamma n \to p\pi^-$, induced by linearly polarized photons of energies from 610 to 940 MeV. The experiment was carried out using the back-scattered laser beam and the 82-in. bubble chamber at SLAC. We compare the new data with predictions from a partial-wave analysis. (auth)

12544 DISCOVERY OF A SECOND NARROW RESONANCE IN e^+e^- ANNIHILATION. Abrams, G.S.; Briggs, D.; Chinowsky, W.; Friedberg, C.E.; Goldhaber, G.; Hollebeek, R.J.; Kadyk, J.A.; Litke, A.; Lulu, B.; Pierre, F.; Sadoulet, B.; Trilling, G.H.; Whitaker, J.S.; Wiss, J.; Zipse, J.E. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720); Augustin, J.; Boyarski, A.M.; Breidenbach, M.; Bulos, F.; Feldman, G.J.; Fischer, G.E.; Fryberger, D.; Hanson, G.; Jean-Marie, B.; Larsen, R.R.; Luth, V.; Lynch, H.L.; Lyon, D.; Morehouse, C.C.; Paterson, J.M.; Perl, M.L.; Richter, B.; Rapidis, P.; Schwitters, R.F.; Tanenbaum, W.; Vannucci, F. Phys. Rev. Lett. 33: No. 24, 1453-1455 (9 Dec 1974).

We have observed a second sharp peak in the cross section for $e^+e^- \to$ hadrons at a center-of-mass energy of 3.695 ± 0.004 GeV. The upper limit of the full width at half-maximum is 2.7 MeV. (auth)

Weak

12545 DISCOVERY OF A NARROW RESONANCE IN e^+e^- ANNIHILATION. Augustin, J.; Boyarski, A.M.; Breidenbach, M.; Bulos, F.; Dakin, J.T.; Feldman, G.J.; Fischer, G.E.; Fryberger, D.; Hanson, G.; Jean-Marie, B.; Larsen, R.R.; Lüth, V.; Lynch, H.L.; Lyon, D.; Morehouse, C.C.; Paterson, J.M.; Perl, M.L.; Richter, B.; Rapidis, P.; Schwitters, R.F.; Tanenbaum, W.M.; Vannucci, F. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305); Abrams, G.S.; Briggs, D.; Chinowsky, W.; Friedberg, C.E.; Goldhaber, G.; Hollebeek, R.J.; Kadyk, J.A.; Lulu, B.; Pierre, F.; Trilling, G.H.; Whitaker, J.S.; Wiss, J.; Zipse, J.E. Phys. Rev. Lett. 33: No. 23, 1406-1408 (2 Dec 1974).

We have observed a very sharp peak in the cross section for $e^+e^- \to$ hadrons, e^+e^-, and possibly $\mu^+\mu^-$ at a center-of-mass energy of 3.105 ± 0.003 GeV. The upper limit to the full width at half-maximum is 1.3 MeV. (auth)

12546 PRELIMINARY RESULT OF FRASCATI (ADONE) ON THE NATURE OF A NEW 3.1-GeV PARTICLE PRODUCED IN e^+e^- ANNIHILATION. Bacci, C.; Celio, R.B.; Berna-Rodini, M.; Caton, G.; Del Fabbro, R.; Grilli, M.; Iarocci, E.; Locci, M.; Mencuccini, C.; Murtas, G.P.; Penso, G.; Spinetti, G.S.M.; Spano, M.; Stella, B.; Valente, V. (The Gamma-Gamma Group, Laboratori Nazionali di Frascati, Frascati, Italy); Bartoli, B.; Bisello, D.; Esposito, B.; Felicetti, F.; Monacelli, P.; Nigro, M.; Paolufi, L.; Peruzzi, I.; Mortemi, G.P.; Piccolo, M.; Ronga, F.; Sebastiani, F.; Trasatti, L.; Vanoli, F.; Barbarino, G.; Barbiellini, G.; Bemporad, C.; Biancastelli, R.; Cevenini, F.; Celvetti, M.; Costantini, F.; Lariccia, P.; Parascandalo, P.; Sassi, E.; Spencer, C.; Tortora, L.; Troya, U.; Vitale, S. Phys. Rev. Lett. 33: No. 23, 1408-1410 (2 Dec 1974).

We report on the results at ADONE to study the properties of the newly found 3.1−BeV particle. (auth)

12547 MEASUREMENT OF THE LIFETIME OF THE POSITIVE MUON. Balandin, M. P.; Grebenyuk, V. M.; Zinov, V. G.; Konin, A. D.; Ponomarev, A. N. (Joint Inst. of Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1631-1637(Nov 1974). (In Russian).

The lifetime of the positive muon is measured on the synchrocyclotron of the Laboratory for Nuclear Problems of the Joint Institute for Nuclear Research. A value of (2.19711 ± 0.00008) μsec is obtained. Decay positrons are recorded by a water Cherenkov detector. Its radiator served simultaneously as the target at the center of which the muons are stopped. Application of a positron detector with 4π-geometry and the high recording efficiency considerably lower the time required for obtaining statistically sufficient data and circumvent some spurious effects. (auth)

12548 DETERMINATION OF THE AXIAL−VECTOR FORM FACTOR IN THE RADIATIVE DECAY OF THE PION. Stetz, A.; Carroll, J.; Ortendahl, D.; Perez−Mendez, V. (Lawernce Berkeley Laboratory, University of California, Berkeley, California 94720); Igo, G.; Chirapatpimol, N.; Nasser, M.A. Phys. Rev. Lett. 33: No. 24, 1455-1458 (9 Dec 1974).

The branching ratio for the decay $\pi \to e\nu\gamma$ has been measured in a counter experiment in which the e^+ was detected in a magnetic spectrometer and the γ ray in a lead−glass hodoscope. From the measured branching ratio we determine γ, the ratio of the axial−vector form factor to the vector form factor. The latter is computed by using conserved−vector−current theory and τ_{π^0}, the π^0 lifetime. Adopting a best value 0.86×10^{16} sec, we obtain $\gamma = 0.15 \pm 0.11$ or $\gamma = -2.07 \pm 0.11$. A comparison between the measured values of γ and various theories is made. (auth)

12549 STRANGE−PARTICLE PRODUCTION IN NEUTRINO INTERACTIONS. Barish, S.J.; Derrick, M.; Hyman, L.G.; Schreiner, P.; Singer, R.; Smith, R.P.; Yuta, H. (Argonne National Laboratory, Argonne, Illinois 60439); Barnes, V.E.; Carmony, D.D.; Garfinkel, A. F.; Kraemer, R.W. Phys. Rev. Lett. 33: No. 24, 1446-1449 (9 Dec 1974).

Seven examples of strange−particle production by neutrinos are observed in the 12−ft bubble chamber. One event represents the first observation of associated production by the weak neutral current. (auth)

12550 MEASUREMENT OF THE $K_L^0 \to \pi^+\pi^-\pi^0$ DALITZ PLOT. Messner, R.; Franklin, A.; Morse, R.; Nauenberg, U. (Department of Physics and Astrophysics, University of Colorado, Boulder, Colorado 80302); Hitlin, D.; Liu, J.; Piccioni, R.; Dorfan, D. Phys. Rev. Lett. 33: No. 24, 1458-1461 (9 Dec 1974).

A Dalitz plot of 509 000 $K_L^0 \to \pi^+\pi^-\pi^0$ decays is analyzed, using $|M|^2 \propto 1 + aY + bY^2 + cX + dX^2 + \ldots$, where X and Y are the Dalitz variables. We find no measurable X dependence; we do find that a significant X^2 and Y^2 dependence is present. In addition, the spectrum cannot be fit with a matrix element linear in Y. Our best fit yields $a = -0.917 \pm 0.13$. $b = 0.149 \pm 0.013$, and $\alpha = 0.055 \pm 0.010$. Comparison with τ decay indicates a definite $|\Delta I| = 1/2$ violation in the nonsymmetric amplitudes. (auth)

Strong (Baryon-induced)

12551 (JINR-P2-8080) DETERMINATION OF THE COUPLING CONSTANTS KNΛ AND KNΣ FROM DATA ON THE DIFFERENTIAL CROSS SECTIONS OF PROCESSES $\bar{p}p \to K^-K^+$, $\bar{p}p \to \bar{\Lambda}\Lambda$, and $\bar{p}p \to \bar{\Sigma}^+\Sigma^+$. Dubnicka, S.; Dumbrais, O. V.; Stashel, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A determination of the coupling constants KNΛ and KNΣ from existing differential cross section data for processes $\bar{p}p \to K^-K^+$, $\bar{p}p \to \bar{\Lambda}\Lambda$, and $\bar{p}p \to \bar{\Sigma}^+\Sigma^-$ were carried out. The method is based on the extrapolation of $d\sigma/d\Omega$ to the hyperon and kaon poles respectively, exploiting conformal mapping techniques. Calculations result in the values which favor SU(3) predictions. (auth)

12552 EXPERIMENTAL LOWER LIMIT ON THE PROTON LIFETIME. Bergamasco, L. (CNR, Turin); Picchi, P. Lett. Nuovo Cim.; 11: No. 14, 636-638(7 Dec 1974).

A lower limit on the proton mean lifetime is derived from the results of measurements carried out at 4270 mwe taking as source only the detector nucleons and thus reducing the background. The lower limit of the proton mean lifetime was found to be $(1.4 \text{ to } 1.6)10^{29}$ years. (JFP)

12553 EXPERIMENTAL OBSERVATION OF A HEAVY PARTICLE J. Aubert, J.J.; Becker, U.; Biggs, P.J.; Burger, J.; Chen, M.; Everhart, G.; Goldhagen, P.; Leong, J.; McCorriston, T.; Rhoades, T.G.; Rohde, M.; Ting, S.C.C.; Wu, S.L. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139); Lee, Y.Y. Phys. Rev. Lett. 33: No. 23, 1404-1406 (2 Dec 1974).

We report the observation of a heavy particle J, with mass m = 3.1 GeV and width approximately zero. The observation was made from the reaction $p + Be \to e^+ + e^- + x$ by measuring the e^+e^- mass spectrum with a precise pair spectrometer at the Brookhaven National Laboratory's 30−GeV alternating−gradient synchrotron. (auth)

12554 SINGLE−PION PRODUCTION AT 100 GeV/c: A DETAILED TEST OF FACTORIZATION. Erwin, J.; Ko, W.; Lander, R.L.; Pellett, D.E.; Yager, P.M. (Department of Physics, University of California, Davis, California 95616); Alston−Garnjost, M. Phys. Rev. Lett. 33: No. 22, 1352-1355 (25 Nov 1974).

A relatively bias−free comparison is made of inclusive and semi−inclusive charged−pion single−particle spectra in π^+ p and pp interactions. Inclusive Mueller factorization is satisfied by π^- but not π^+ production. Factorization holds for proton−target fragmentation into π^- for a fixed number of π^- backward in the c.m. system, but not for fixed total multiplicity. In the central region, $\pi^+p \to \pi^\pm$ shows an $s^{-1/4}$ approach to the same value, ~0.78, seen in other reactions. (auth)

12555 CHARACTERISTICS OF MULTIPLE PRODUCTION OF MESONS AROUND 100 TeV FROM CHACALTAYA COSMIC-RAY EXPERIMENT. Brazil−Japan Emulsion Collaboration. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Notas Fis., Cent. Brasil. Pesqui. Fis.; 23 (Suppl.): (1974).

Observations are made on two kinds of events detected using emulsion chambers exposed at Mt. Chacaltaya, Bolivia (5,220 m, 550 g/cm²): atmospheric interactions (10^2 TeV $\lesssim E_{lab} \lesssim$ 240 TeV) and local interactions in a target layer (15 TeV $\lesssim E_{lab} \lesssim$ 240 TeV). Energy and angular distributions of secondary gamma-rays (neutral pions) were constructed and found to be consistent with the isotropic decay of moving centers (intermediate states 1.5.) of three types, each of constant mass and "temperature". The average mass value for the first type is $M_\gamma^* \simeq 1.3 \pm 0.3$ GeV/c² for the gamma-ray part and 2 to 3 GeV/c² for the pionic rest mass. The mass spectrum of the 1.5. ("fireballs") shows three peaks. The majority of events have the gamma-ray invariant mass around 1 GeV/c², while there is a group of events with large mass, $M_\gamma^* \sim 5$-8 GeV/c², and finally there is an intermediate state with $M_\gamma^* \sim 50$-100 GeV/c². The pion clusters recently found in the accelerator experiments can be identified to the small mass I.S. (S.I.S.) identified since 1967 in cosmic-ray experiments. Pion emission from the large mass I.S. (L.I.S.) (also identified since 1967) gives larger multiplicity and larger mean momentum, and so can possibly be the explanation for the large transverse momenta secondaries found in ISR experiments. Analysis of extremely high energy atmospheric interactions (10^3 TeV $\lesssim E_{lab} \lesssim 10^5$ TeV) with very large multiplicity suggests the existence of the third intermediate state, with mass $M_\gamma^* \sim 50$ to 100 GeV/c². An event is also described where large number of nuclear-active particles was emitted, neutral pions being absent. (auth)

12556 LIKE− AND UNLIKE−CHARGED PION CORRELATIONS IN π^+p AND pp INTERACTIONS AT 100 GeV/c. Erwin, J.; Ko, W.; Lander, R.L.; Pellett, D.E.; Yager, P.M. (Department of Physics, University of California, Davis, California 95616); Alston−Garnjost, M. Phys. Rev. Lett. 33: No. 24, 1443-1446 (9 Dec 1974).

Charged−pion rapidity correlations are compared and found to have a similar peaked structure when studied inclusively. However, when the same data are studied semi−inclusively, no correlation is found for like−charged pions and for unlike−charged pions in the central region. Inclusive correlations in these cases appear then from the convolution of the uncorrelated spectra at each multiplicity and the multiplicity distribution. Correlation in $\pi^+\pi^-$ is observed at small Δy only for y large. (auth)

12557 NEUTRON−PROTON CHARGE−EXCHANGE SCATTERING BETWEEN 600 AND 2000 MeV/c. Shepard, P.F.; Devlin, T.J.; Mischke, R.E.; Solomon, J. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 10: No. 9, 2735-2762 (1 Nov 1974).

n−p elastic differential cross sections in the charge−exchange region have been measured for incident neutron momenta between 600 and 2000 MeV/c. The momentum of neutrons incident on a liquid−H_2 target was determined by a measurement of flight time over a 32.9−m flight path. The momentum and scattering angles of the recoil proton were measured by a wire−spark−chamber magnetic spectrometer. Approximately 450000 elastic events were detected for proton laboratory angles between 0° and 62°. Differential cross sections are presented at 16 energies. An absolute normalization of the cross sections was achieved by measuring the incident neutron flux with a detector whose efficiency was determined experimentally. (auth)

12558 TWO−PION CORRELATIONS IN pp COLLISIONS AT 102 GeV/c. Bromberg, C.; Cohen, D.; Chaney, D.; De Brion, J.P.; Ferbel, T.; Slattery, P. (University of Rochester, Rochester, New York 14627); Cooper, J.; Seidl, A.; Vander Velde, J.C. Phys. Rev. D 10: No. 9, 3100-3104 (1 Nov 1974).

We have measured two–pion correlations in rapidity and transverse momentum in pp collisions at 102 GeV/c. The correlations, which are highly sensitive to the charges of the pions, display a behavior consistent with that expected on the basis of the short–range–order hypothesis, and, when compared with a model which does not contain explicit correlations, suggest the presence of substantial dynamic correlations in the data. (auth)

12559 SEARCH FOR MASSIVE PENETRATING PARTICLES PRODUCED BY 300–GeV PROTONS. Cronin, J.W.; Frisch, H.J.; Shochet, M.J. (The Enrico Fermi Insitute, University of Chicago, Chicago, Illinois 60637); Boymond, J.P.; Mermod, R.; Riroué, P.A.; Sumner, R.L. Phys. Rev. D 10: No. 9, 3093-3094 (1 Nov 1974).

We have searched for negative long–lived penetrating particles of mass between 1.0 and 6.8 GeV/c^2 produced by 300–GeV protons incident on Cu. At 2.38–GeV/c transverse momentum no event was found as compared to a yield of 1.28×10^9 π^-. The 90%–confidence–level upper limit for the invariant production cross section per nucleon is $Ed\sigma/d^3p = 5.4 \times 10^{-39}$ cm^2 GeV^{-2}. (auth)

12560 ANALYSIS OF TOPOLOGICAL CROSS SECTIONS IN $\bar{P}P$ INTERACTIONS AT 22.4 GeV/c. Abesalashvili, L. N.; Amaglobeli, N. S.; Boguslavsky, I. V.; Chyla, J.; Cvach, J.; Dzhmukhadze, S. V.; Gramenitsky, I. M.; Herynek, I.; Kiselevich, U. A.; Korzhavina, I. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). Phys. Lett., B; 52: No. 2, 236-238(30 Sep 1974).

The multiplicity distribution for 11558 events in $\bar{p}p$ interactions at 22.4 GeV/c was analyzed. The average charged multiplicity $\langle n_{ch} \rangle$ for inelastic events was found to be 4.69 ± 0.05 and $\langle n_{ch} \rangle / D = 2.04 \pm 0.05$. The early KNO scaling of normalized topological cross sections was tested. (auth)

12561 SIMULTANEOUS MEASUREMENT OF 2 AND 3 SPINS IN PROTON PROTON ELASTIC SCATTERING AT 6 GeV/c. Fernow, R. C.; Gray, S. W.; Krisch, A. D.; Miettinen, H. E.; Roberts, J. B.; Terwilliger, K. M. (Michigan Univ., Ann Arbor (USA). Harrison M. Randall Lab. of Physics); DeBoer, W. (European Organization for Nuclear Research, Geneva (Switzerland)); Parker, E. F.; Ratner, L. G. (Argonne National Lab., Ill. (USA)); O'Fallon, J. R. (Saint Louis Univ., Mo. (USA). Dept. of Physics). Phys. Lett., B; 52: No. 2, 243-246(30 Sep 1974).

The elastic cross section for proton proton scattering at 6 GeV/c was measured using a 70% polarized beam and a 75% polarized target at the Argonne ZGS. In the range $P_\perp^2 = 0.5 \rightarrow 2.0$(GeV/c)^2 small error measurements were obtained for the ↑↑, ↓↓ and ↑↓ initial spin states perpendicular to the scattering plane. At $P_\perp^2 = 0.5$ the recoil spin was also measured, and it was found that the 5 different cross sections were unequal. (auth)

12562 NUCLEAR COLLISIONS AT SUPER-HIGH ENERGIES. Babecki, J.; Czachowska, Z.; Furmanska, B.; Gierula, J.; Holynski, R.; Jurak, A.; Krzywdzinski, S.; Nowak, G.; Slezak, B.; Wolter, W. (Institute of Nuclear Physics, Krakow (Poland)). Phys. Lett., B; 52: No. 2, 247-248(30 Sep 1974).

The development of the angular distributions of particles produced in proton-nucleus collisions in the energy range between 67 and about 3000 GeV is presented. (auth)

Strong (Meson-induced)

12563 (CONF-740673-1) NEW DIRECTIONS IN POLARIZATION PHYSICS. Yokosawa, A. (Argonne National Lab., Ill. (USA)). 1974. 28p. Dep. NTIS $4.50.

From workshop on polarized targets; Upton, L. I., New York, USA (Jun 1974).

New directions in polarization physics involve decisive measurements to determine scattering amplitudes of two-body and multibody final-state reactions. The current status of a number of reactions is discussed, and rather large amounts of data are given where available. The following reactions are considered; the notation "D" indicates that data are shown in the paper: πp elastic scattering (D), πp charge-exchange reactions (D), Kp elastic scattering (D), Kp charge exchange (D), pp elastic scattering (D), $\bar{p}p$ elastic scattering, $\bar{p}p$ charge-exchange reactions (D), np elastic and np charge exchange (D), $\pi^- p \rightarrow \eta^0 n$ (D), π-induced hypercharge exchange (D), K-induced hypercharge exchange, $\pi p \rightarrow \rho N$ and $\bar{\pi} p \rightarrow \pi\pi N$, $\bar{p}p \rightarrow \pi^+\pi^-$, and inclusive polarization measurements in pion reactions. (16 figures) (RWR)

12564 (JINR-P1-8187) MULTIPLICITY OF SECONDARY PARTICLES PRODUCED IN π^-p-INTERACTIONS AT 40 GeV/c. Angelov, N.; Grishin, V. G.; Kerachev, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 14p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The multiplicity distributions of π^0-mesons and of all the secondary particles produced in π^-p-interactions at 40 GeV/c are obtained. The obtained data are compared with the phenomenological model. (auth)

12565 FRACTION OF ENERGY CARRIED AWAY BY CHARGED AND NEUTRAL MESONS IN THE INTERACTION OF π^- MESONS WITH NUCLEONS AND LIGHT AND HEAVY NUCLEI AT ENERGIES OF 17 GeV. Maslennikova, N. V.; Mel'nichuk, T. A.; Tret'yakova, M. I. Kratk. Soobshch. Fiz.; No. 2, 16-23(1974). (In Russian).

By means of emulsions irradiated in a magnetic field H = 165 kOe with π^- mesons at a momentum of 17 GeV/c, the inelasticity coefficients were determined for π^- meson-nucleon and π^- meson-nucleus interactions. It was shown that $\langle K_{\pi^0+K^0} \rangle$ for interaction on nucleons and light and heavy nuclei equals 0.33 ± 0.02, 0.35 ± 0.03, and 0.35 ± 0.02, respectively. (tr-auth)

12566 ESTIMATE OF THE BACKWARD ELASTIC π^-d SCATTERING CROSS SECTION AT 3.7 GeV/c. Aref'ev, A. V.; Bayukov, Yu. D.; Efremenko, V. I.; Zaitsev, Yu. M.; Leksin, F. A.; Suchkov, D. A.; Khasanov, F. M. JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 397(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 775-776(20 Jun 1974).

The upper bound of the backward elastic π^-d scattering cross section at an initial π^--meson momentum 3.7 GeV/c, namely, $d\sigma\pi^- d/d\Omega_{180^\circ} \leq 3.7 \times 10^{-32}$ cm^2/sr is determined. (auth)

12567 COSMIC RAY PROTON INTERACTIONS WITH ATMOSPHERIC NUCLEI AT 100 TO 800 GeV. Weiner, S. R. Ann Arbor, MI; Univ. of Michigan (1974). 149p. University Microfilms Order No. 74-25,356.

Thesis (Ph. D.).

Properties of interactions of 100 to 800 GeV cosmic ray protons with atmospheric nuclei were deduced from relative frequencies of occurrence, estimated energies, and extent of air shower accompaniment of charged and neutral cosmic ray hadrons. The hadrons were observed by means of interactions they experienced in one of 17 iron plates of a multi-plate cloud chamber located at the site of the Bolivian Air Shower Joint Experiment (BASJE) on Mt. Chacaltaya in Bolivia. Energies were estimated from the size of cascades emerging from material situated between the cloud chamber and a set of scintillation detectors lying below. Extent of shower accompaniment was determined by an array of scintillation detectors surrounding the cloud chamber. Particular care was used in the analysis in defining and distinguishing between accompanied and unaccompanied hadrons. Quantities determined were neutral (neutron)-to-charged ratios (n/c); ratio of primary protons to unaccompanied hadrons (p_p/c); probability of nucleon charge exchange (X); neutron-to-proton ratios (n/p); charged pion-to-proton ratios (π/p); slope of the integral energy spectrum for unaccompanied hadrons (γ); and the average elasticity (η) for proton collisions with atmospheric nuclei. From the determined properties, it was possible to obtain information about high energy interactions and the propagation of the hadronic component of extensive air showers in the atmosphere. Conclusions with respect to high energy interactions and those with respect to the propagation of the hadronic air shower component are given. (Diss. Abstr. Int., B)

12568 PRODUCTION OF ρ^- IN THE NUCLEAR COULOMB FIELD. Gobbi, B.; Rosen, J.L.; Scott, H.A. (Northwestern Unversity, Evanston, Illinois 60201); Shapiro, S.L.; Strawczynski, L.; Meltzer, C.M. Phys. Rev. Lett. 33: No. 24, 1450-1453 (9 Dec 1974).

The coherent process $\pi^- + A \rightarrow A + \pi^- + \pi^0$ has been measured using nuclear targets. Sharp peaks are observed in the t' distributions. The $\pi\pi$ mass spectrum is dominated by the ρ^- meson produced in the nuclear Coulomb field and by ω^0 exchange in the nuclear surface. The Coulombic process yields a measurement of the radiative width, $\Gamma(\rho^- \rightarrow \pi^- + \gamma) = 35 \pm 10$ keV, which is in poor agreement with the simple unbroken–SU(3) prediction of 100 keV. (auth)

12569 K^+–PROTON SCATTERING FROM 200 TO 600 MeV/c. Burnstein, R.A.; LeFebvre, J.J.; Petersen, D.V.; Rubin, H.A. (Illinois Institute of Technology, Chicago, Illinois 60616); Day, T.B.; Fram, J.R.; Glasser, R.G.; McClellan, G.; Sechi–Zorn, B.; Snow, G.A. Phys. Rev. D 10: No. 9, 2767-2777 (1 Nov 1974).

The differential cross section for K^+p elastic scattering has been measured at several momenta in the interval 200–600 MeV/c within a hydrogen bubble chamber. The data have been fit with a partial–wave analysis. We obtain solutions which are dominated over the entire momentum range by s–wave scattering, with constructive interference between the nuclear and Coulomb scattering. The effective–range approximation with only s–waves yields a K^+p scattering length $a = -0.314 \pm 0.007$ F and an effective range $r_0 = 0.36 \pm 0.07$ F. The measured total inelastic cross section at 588 MeV/c is 11_{-3}^{+9} μb. (auth)

12570 MEASUREMENT OF THE BACKWARD PEAKS IN THE REACTIONS $\pi^-p \to K^0\Lambda$ AND $\pi^-p \to K^{*0}(890)\Lambda$. Foley, K.J.; Love, W.A.; Ozaki, S.; Platner, E.D.; Saulys, A.C.; Willen, E.H. (Brookhaven National Laboratory, Upton, New York 11973); Lindenbaum, S.J.; Kramer, M.A. Phys. Rev. D 10: No. 9, 2763-2767 (1 Nov 1974).

We present the differential cross sections near $u = 0$ for the reactions $\pi^-p \to K^0A$ and $\pi^-p \to K^{*0}(890)\Lambda$ at incident pion momenta of 8 and 10.7 GeV/c. The differential cross section for the first reaction follows the exponential dependence on u previously observed while the second shows a dip in the backward direction. (auth)

12571 INVESTIGATION OF RARE NON-STRANGE DECAY MODES OF THE f MESON IN π^+p INTERACTIONS AT 5 GeV/c. Eisenberg, Y.; Engler, A.; Haber, B.; Karshon, U.; Mikenberg, G.; Pitluck, S.; Ronat, E. E.; Shapira, A.; Yekutieli, G. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Phys. Lett., B; 52: No. 2, 239-242(30 Sep 1974).

Rare decay modes of the f meson are studied in the final states $\Delta^{++}\pi^+\pi^-\pi^+\pi^-$, $\Delta^{++}\pi^+\pi^-$ MM and $\Delta^{++}\pi^+\pi^-\pi^+\pi^-$ MM. The ratio $\Gamma(f \to \pi^+\pi^-\pi^0\pi^0)/\Gamma(f \to \pi^+\pi^-)$ is 0.23 ± 0.09 and $\Gamma(f \to 4\pi)$ saturates the f inelasticity. A 2 s.d. upper limit of 0.09 is found for the branching ratio $(f \to \eta\eta)/f \to 2\pi)$. (auth)

Particle Interactions and Properties (Theoretical)

General

12572 (DEMO-74/14) EFFECTS OF THE INCLUSIVE DIPOLE-POMERON TO EXCLUSIVE PROCESSES. Antoniou, N. G.; Kouris, C. B.; Papaioannou, G. M.; Manesis, E. K. (Democritus Nuclear Research Center, Athens (Greece); Ioannina Univ. (Greece)). 1974. 11p. Dep. NTIS (US Sales Only) $4.00.

The consequences of the inclusive dipole-Pomeron for the exclusive processes are investigated. In the weak coupling limit a two component picture for the production mechanism is obtained and self-consistency of the inclusive Pomeron dipole is found. (auth)

12573 (HU-TFT-74-8) SHRINKAGE OF THE ELASTIC DIFFERENTIAL CROSS-SECTION FROM THE MULTIPERIPHERAL MODEL USING UNITARITY. Sohlo, S. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The overlap function was calculated analytically from a simplified Chan–Loskiewicz–Allison (CLA) model with Regge phase. Hamer and Peierls have shown using the impact parameter variables that in the CLA model with Regge phase the slope of the overlap function increases too rapidly with total energy when compared to experiments. According to Jadach and Turnau this was due to inadequate approximations made for the norm of the CLA amplitude and they showed that in the CLA model with no momentum dependent phase the shrinkage agrees with experiments but the magnitude of the slope is too small. It is shown without making the inadequate approximations mentioned by Jadach and Turnau that when the Regge phase is used in the CLA model, it makes the overlap function to shrink too rapidly and to have a too large slope above 20 GeV/c. Clustering will improve the agreement with experiment, but is hardly sufficient. The analytic calculations make it possible to discuss contributions to the overlap function from various properties of the production amplitude. (auth)

12574 (IFVE-STF-71-93) ASYMPTOTIC PROPERTIES OF CROSS-SECTIONS FOR INCLUSIVE REACTIONS. Logunov, A. A.; Mestvirishvili, M. A.; Nguen van Hieu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1971. 9p. INIS.

Investigation of the analytic properties of the scattering amplitude made it possible to discover profound physical interrelations between different processes and phenomena. For the two-body processes where the amplitude depends only on two independent variables these relations become extremely simple at high energies. Another global characteristic of the inclusive reactions is the effective range of the inelastic interaction of the particles "a" and "b" with the production of "c" denoted by $R^c_{inel}(S)$. (auth)

12575 (IFVE-STF-73-51) QUARK MODEL AND INCLUSIVE SPECTRA IN THE CENTRAL REGION ABSOLUTE VALUE $[P_L\,(cm)]$ APPROX. $= 0.3P_{max}$. Anisovich, V. V.; Kobrinskii, M. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 14p. INIS.

The particle spectra are well described by the quark model with the assumption that the $xd\sigma/dx$ distributions are constant in the broad interval of x. The quark model prediction for p and $\bar{p}$ spectra at $x = 0$ agrees with p spectrum, and $\bar{p}$ spectrum tends to the predicted cross section as the energy increases. The parameter λ which characterizes the relative probability of the strange quark production grows from $\lambda = 0.3$ to $\lambda = 0.6$ with the energy increase from $E = 20$ to $E = 500$ GeV. It permits one to think that λ tends to a unity at asymptotic energy. In this case, the model would be realized, in which all the quarks are equivalent. (auth)

12576 (INIS-mf-1253) DUAL RESONANCE MODEL AND ITS COMPARISON WITH EXPERIMENTAL DATA. Hoyer, P. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1973. 21p. INIS.

Thesis.

Both theoretical and phenomenological properties of the dual resonance model were studied. The main attention is given to the behavior of multi-particle amplitudes at high temperatures. It is shown that the amplitude factorize, in other words, that the particles, between which the energy is great, are uncorrelated. The dual resonance model is also compared with the experimental results, whereas there are three particles at final state. Along common physical principles same amplitude describes many various physical reactions. It is shown that this also is valid for the dual resonance model. (JPL)

12577 (ITF-73-79E) STATISTICAL AND DYNAMICAL FEATURES OF DUAL RESONANCES. Gorenshtein, M. I.; Miranskii, V. A.; Struminskii, B. V.; Sheiest, V. P.; Zinov'ev, G. M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1973. 18p. INIS.

A dual resonance model is considered from the statistical point of view. Average characteristics are calculated: resonance state densities, average spin, complete and partial widths of heavy resonance decay. The results obtained allow one to treat the dual model as dynamic realization of basic assumptions of the bootstrap theory. A new type of averaging was introduced to take effectively into account many features of strong interaction dynamics. A qualitative consideration of possible mechanisms for hadron generation in high energy collisions is given. (auth)

12578 NEW PARTICLES. CERN Cour.; 14: No. 12, 415-419 (Dec 1974).

The existence of new heavy, stable particles in a mass region where they were completely unexpected with stability properties which at this stage of the game are completely inexplicable is treated. The discoveries are described, and then some of the speculations as to what the discoveries might mean are discussed. (JFP)

12579 INFRARED PROBLEM IN A MODEL OF SCALAR ELECTRONS AND MASSLESS SCALAR BOSONS. Froehlich, J. (Eidgenoessische Technische Hochschule, Zurich). Ann. Inst. Henri Poincare, Sect. A; 19: No. 1, 1-103(1973).

The infrared problem is investigated in the framework of simple models (closely related to Nelson's model). These models describe the interaction of conserved, charged, scalar particles (called electrons) and relativistic, neutral scalar bosons of rest mass 0. They exhibit an infra-particle situation and proper infrared problems in the construction of dressed one-electron states and scattering amplitudes. A renormalized Hilbert space is constructed such that the spectrum of the energy-momentum operator on this Hilbert space contains a unique one electron shell corresponding to dressed one electron states. However, the spectrum of the energy-momentum operator on the physical Hilbert space does not contain a one electron shell. Several concepts for a collision theory on the charge one sector are developed. These concepts are compared with the proposals of Faddeev and Kulish, and a list of interesting yet unsolved problems is presented. (auth)

12580 SPIN–STATISTICS CONNECTION FOR DYONIUM. Barut, A.O. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev. D 10: No. 8, 2709-2711 (15 Oct 1974).

The spin $-1/2$ bound state of two spinless dyons (dyonium) has additional independent (gauge) degrees of freedom associated with an arbitrary unit vector $\hat{n}$ in the Hamiltonian. Hence it does not constitute a counterexample of the normal spin–statistics connection. (auth)

12581 REPLY TO "SPIN–STATISTICS CONNECTION FOR DYONIUM". Mahanthappa, K.T. (Department of Physics and Astrophysics, University of Colorado, Boulder, Colorado 80302). Phys. Rev. D 10: No. 8, 2712-2713 (15 Oct 1974).

It is indicated that, despite the existence of unit vector $\hat{n}$, our previous conclusion that the dyonium model of Barut is invaiidated

remains unaltered, contrary to the claims of the preceding paper. Also, we point out that the assertions contained in the preceding paper forbid the existence of triplet states of two protons and allow only a singlet state, contradicting experimental facts. Other related aspects are discussed. (auth)

12582 ANALYTICITY AND BOUNDS ON THE SCATTERING AMPLITUDE AT FINITE ENERGIES. Vernov, Yu. S. (Inst. of Nuclear Research, Moscow). Teor. Mat. Fiz.; 21: No. 2, 195-206(Nov 1974). (In Russian).

The system of relations is obtained, which connects with each other different integrals of the real and imaginary parts of the scattering amplitude or the logarithm of the latter. With the aid of these relations the connections between the phase and the modulus of the amplitude at arbitrary energies are investigated and the bounds on the amplitude and on the ratio of the particle and antiparticle scattering amplitudes are found. (auth)

12583 MULTICHANNEL PROCESSES IN VN- AND VV-SECTORS IN AN EXTENDED LEE MODEL. Choudhury, A. L. (Elizabeth City State Univ., NC). Acta Phys. Acad. Sci. Hung.; 36: No. 3, 253-267(30 Sep 1974).

The Lehmann–Symanzik–Zimmermann (LSZ) formalism is used in an extended Lee model to calculate the multichannel scattering and production amplitudes in VN- and VV-sectors. The extended model is comprised of two recoilless particles V and N; and nθ particles. The interactions are in such a way that only processes $V \rightleftharpoons N\theta_i$, i = 1,2, ..., n, are allowed. In this multi-θ Lee model, the τ-functions are evaluated by solving the Matthews–Salam equations in the VN- and VV-sectors. Finally the multichannel scattering and production amplitudes are obtained by using standard techniques. (auth)

12584 MULTICHANNEL PROCESSES IN V- AND $V\theta_i$-SECTORS IN AN EXTENDED LEE MODEL. Choudhury, A. L. (Elizabeth City State Univ., NC). Acta Phys. Acad. Sci. Hung.; 36: No. 3, 241-251(30 Sep 1974).

The Lehmann–Symanzik–Zimmermann (LSZ) formalism is used in a multi-θ extended Lee model to calculate the relevant multichannel scattering and production amplitudes. The extended multi-θ Lee model introduces nθ particles in addition to heavy recoilless V and N particles of the normal Lee model. The processes allowed are $V \rightleftharpoons N\theta_i$, for i = 1,2, ...,n. In the V- and $V\theta_i$-sectors, all the τ-functions are obtained by solving the Matthews–Salam equations for the τ-functions. The multichannel scattering and production amplitudes are also evaluated. (auth)

12585 ON THE FACTORIZATION OF THE POMERANCHUK SINGULARITY IN THE MUELLER-REGGE DIAGRAMS. Antoniou, N. G. (European Organization for Nuclear Research, Geneva (Switzerland)); Kouris, C. B.; Papaioannou, G. M. (Democritus Nuclear Research Center, Athens (Greece)). Phys. Lett., B; 52: No. 2, 207-209(30 Sep 1974).

It is shown that the j plane singularity (Pomeron) which leads to a rising total cross section like $(\ln s)^{\epsilon}$, $\epsilon > 0$, cannot be factorizable in the Mueller diagrams for inclusive production of particles with large rapidity differences. The relevance of this result for the theories of a renormalized Pomeron is discussed. (auth)

12586 RESTRICTED CROSS SECTIONS. Suranyi, P. (Cincinnati Univ., Ohio (USA). Dept. of Physics). Phys. Lett., B; 52: No. 2, 233-235(30 Sep 1974).

Multiparticle processes with only neutral final state particles are shown to be useful to study multiperipheral dynamics without the presence of recently introduced corrections due to diffraction, clusterings, multi-Pomeranchukon contributions, etc. (auth)

12587 DUAL-RESONANCE MODELS. Mandelstam, S. (California Univ., Berkeley (USA). Dept. of Physics). Phys. Rep.; 13: No. 6, 259-353(Oct 1974).

97 refs.

Dual-resonance models are treated both as S-matrix theories and as systems of interacting strings. It is shown how Veneziano was able to construct a dual four-point amplitude with narrow resonances and rising Regge trajectories. The construction is generalized to the N-point amplitude in the manifestly dual manner suggested by Koba and Nielsen. The operator formalism which exhibits the factorization property of the above amplitude is developed. The related questions of ghost elimination and null states are discussed. Models with extra degrees of freedom and, in particular, the Neveu-Schwarz-Ramond model with spin, are treated. The latter model has a quark-line spectrum of mesons, but it possesses massless vector mesons and fermions. It is shown how the operator formalism is related to a quantized string. The theory of such a string is developed, with particular emphasis on the ghost-free "Coulomb-gauge" quantization. By constructing theories of interacting strings, the dual-model S-matrix is reproduced. A brief account is given of the theory of loops, in which one attempts to improve on the narrow-resonance model in a perturbative manner. (auth)

Electromagnetic

Refer also to abstract 12855.

12588 (DESY-74/43) DO WE SEE ANOMALOUS DIMENSIONS IN e^+e^- INCLUSIVE ANNIHILATION AT Q = 4 GeV? Rittenberg, V.; Schiller, D. H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Sep 1974. 10p. Dep. NTIS (US Sales Only) $4.00.

It is shown in the framework of scale invariant models that a simple ansatz for the anomalous dimensions allows one to determine the experimentally observed variation with Q of the one-charged particle inclusive cross section. The calculation sheds no light on the behavior of σ_{had} with Q since one worked with the inclusive cross section normalized to the experimentally measured σ_{had}. (auth)

12589 (DL/TM-127) SYNCHROTRON RADIATION: A BIBLIOGRAPHY. Supplement August 1972 to February 1974. Marr, G. V.; Munro, I. H.; Sharp, J. C. C. (Science Research Council, Daresbury (UK). Daresbury Lab.). Mar 1974. 98p. Dep. NTIS (US Sales Only) $8.00.

The bibliography is arranged in sections, entitled: general articles and reviews; synchrotron radiation theory; synchrotron sources; instrumentation; experimental physics (atomic and molecular physics, solid state physics, x-ray diffraction, plasmas); astrophysics and synchrotron radiation. (UK)

12590 ELECTRON–POSITRON ANNIHILATION: UNITARITY, SCALING, AND ELECTRODYNAMICS AT HIGH ENERGIES. Karl, G. (Univ. of Gulph, Canada). Acta Phys. Pol., B5: No. 6, 879-891(1974).

Recent work on e^+e^- annihilation by Cabibbo, Wolfenstein and the author is reviewed. The restrictions of unitarity are analyzed, and the connection between the cross sections σ_h (into hadrons) and σ_μ (into muons) is derived. The possibility of nonscaling in e^+e^- annihilation is studied, and it is pointed out that it leads to no contradiction with presently available information. It is further pointed out that nonscaling could provide a cut-off mechanism for quantum electrodynamics. (auth)

12591 VECTOR MESON PRODUCTION BY INELASTIC SCATTERING OF POLARIZED ELECTRONS OFF POLARIZED NUCLEONS. Fraas, H. (Physikalisches Institut der Universität, Würzburg, Germany). Ann. Phys. (N.Y.) 87: No. 2, 417-456 (Oct 1974).

A general analysis of vector meson production by inelastic scattering of polarized electrons (or muons) off polarized nucleons is presented. Cross section and vector meson decay angular distribution are discussed in terms of s–channel helicity amplitudes for natural and unnatural parity exchange. The question of experiments suitable for analyzing the more refined dynamical features of ρ^0–production is discussed in detail. Estimates are given for the effects to be expected from unnatural parity exchange. (auth)

12592 RESONANCE EFFECTS IN THE MOTION OF A CHARGED PARTICLE IN THE FIELD OF A PLANE ELECTROMAGNETIC WAVE AND CONSTANT MAGNETIC FIELD IN THE MEDIUM. Arutyunyan, V. M.; Avetisyan, G. K. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 2, 110-119(1974). (In Russian).

The motion of a charged particle in the field of plane electromagnetic wave in a medium is considered in the presence of constant longitudinal magnetic field. Unlike the vacuum case, the resonance arises and new effects take place due to the multiphoton absorption of particle near the resonance both in media with refractive indices n > 1 and n < 1. (auth)

12593 X-RAY TRANSITION RADIATION NEAR THE K ABSORPTION EDGE. Arakelyan, V. A.; Garibyan, G. M.; Jang, C. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 2, 120-126(1974). (In Russian).

The effect of scattering near the K-edge on the formation of x-ray transition radiation is considered. (auth)

12594 EIGENVALUE CONDITIONS AND ASYMPTOTIC FREEDOM FOR HIGGS–SCALAR GAUGE THEORIES. Chang, N. (Physics Department, City College of the City University of New York, New York, New York 10031, College of General Education, University of Tokyo (Komaba), Tokyo, Japan, and Research Institute for Fundamental Physics, Kyoto University, Kyoto, Japan). Phys. Rev. D 10: No. 8, 2706-2709 (15 Oct 1974).

Eigenvalue conditions are obtained from a study of the renormalization-group equations for a non-Abelian gauge theory with Higgs scalars. With these conditions, it is found that the theory is asymptotically free. For the purely leptonic SO(3) model of Georgi and Glashow, the eigenvalue conditions fix completely the parameters of the theory. (auth)

12595 ASYMPTOTIC BEHAVIOR OF TWO-PHOTON EXCHANGE IN MASSIVE QUANTUM ELECTRODYNAMICS. Davidson, M. (Physics Department, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). Phys. Rev. D 10: No. 8, 2464-2473 (15 Oct 1974).

The Bethe-Salpeter equation is used in conjunction with the Froissart bound (assumed true off the mass shell) to put restrictions on two-photon exchange. Implications are discussed. (auth)

12596 MODELS FOR THE ANNIHILATION OF e^+e^- → HADRONS. Humpert, B. (Univ., Geneva). Helv. Phys. Acta; 47: No. 4, 491-503(1974).

The reaction e^+e^- → hadrons shows at $E_{CM} \sim 5$ GeV a clear violation of scaling. The experimental results are briefly presented. The models and speculations about the rising ratio $R(q^2) = [\sigma(e^+e^- \to h)/\sigma(e^+e^- \to \mu^+\mu^-)]$ are sketched. (auth)

12597 COMPARISON OF CALCULATIONS OF EXTENSIVE AIR SHOWERS CHARACTERISTICS WITH EXPERIMENTAL RESULTS AT DIFFERENT HEIGHTS. Popova, L. M. (Bylgarska Akademiya na Naukite, Sofia. Fizicheski Inst. s ANEB). Compt. Rend. Acad. Bulg. Sci.; 26: No. 6, 743-746(1973). (In Russian).

Characteristics of extensive air showers were determined by Monte Carlo and analytical methods. Data are presented along with comparisons of experimental and theoretical values. (INIS)

12598 NUMERICAL RESULTS FOR NONRELATIVISTIC COMPTON SCATTERING OF PHOTONS BY K-SHELL ELECTRONS IN THE DIPOLE APPROXIMATION. Gavrila, M. (Univ. of Bucharest). Rev. Roum. Phys.; 19: No. 5, 473-487 (1974).

An exact analytic expression was obtained previously for the cross section of the nonrelativistic Compton-type inelastic scattering of photons by electrons bound in the K-shell of a hydrogen-like atom. The cross section, differential with respect to the angle and the energy of the scattered photon, is proportional to $C_1 + C_2 \cos^2\theta$, where θ is the scattering angle of the photon. The coefficients C_1 and C_2 are combinations of hypergeometric functions of two variables of Appell's type F_1, depending on the atomic number Z and the energies of the initial and final photons κ_1, κ_2 through the dimensionless variables $k_i = \kappa_i/Z^2 \cdot R$, $i = 1,2$, where R is the rydberg. The results of an extensive numerical computation of this analytic cross section are now presented for the energy range $1.05 \le k_1 \le 20$. For each value of k_1, the coefficients C_1 and C_2 were computed for a number of values of k_2 ($0 \le k_2 \le k_1 - 1$). C_1 and C_2, and therefore the cross section itself, turn out to be monotonically decreasing functions of k_2, presenting the infrared-divergent behavior $1/k_2$ for $k_2 \to 0$. (auth)

12599 RADIATIVE DECAY OF PSEUDOSCALAR MESONS. van der Merwe, P. du T. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). S. Afr. J. Sci.; 69: 149-150(May 1973). 11 refs.

The radiative decays of pseudoscalar mesons are discussed in connection with current algebra. It is shown that the dynamical content of the decay, based on the vertex mechanism can be carried out without invoking any approximations. An equation for the decay width is deduced. This result provides a fair description of the π and η radiative decays with certain provisions for the coupling constants. (INIS)

12600 EFFECT OF ENERGY LOSSES ON BREMSSTRAHLUNG BY RELATIVISTIC ELECTRONS. Baryshevskii, V. G. (Belorussian State Univ., Minsk). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1651-1659(Nov 1974). (In Russian).

The radiation emitted by high energy electrons traversing a matter—vacuum interface is investigated. It is shown that in the high energy limit the theory which neglects variation of the multiple scattering constants is identical to that which takes such variation into account. It is shown that the angular and spectral distributions in the limit of high electron energies are the same as those obtained in the coherent length representation. It is pointed out that polarization of the medium should be taken into account in the kinetic equation describing the motion of ultra-relativistic electrons in matter. (auth)

12601 TWO-PARTICLE INCLUSIVE ELECTROPRODUCTION Ahmed, M.A. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev. D 10: No. 9, 3139-3144 (1 Nov 1974).

We construct a Feynman diagram model to describe two-particle inclusive electroproduction processes. The cornestone of the model is Regge behavior which is implemented via spin-J exchanges. The scaling laws for the structure functions are obtained. (auth)

12602 CORRESPONDENCE ARGUMENTS FOR WIDE-ANGLE COMPTON SCATTERING. Scott, D.M. (Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge, England). Phys. Rev. D 10: No. 9, 3117-3118 (1 Nov 1974).

The correspondence principle of Bjorken and Kogut is applied semilocally, using the dominance near threshold of the valence-quark contributions to electroproduction structure functions. The cross section for wide-angle Compton scattering, including normalization, is discussed. (auth)

12603 BOUNDS AND THRESHOLD CONSTRAINTS FOR NUCLEON STRUCTURE FUNCTIONS. Razmi, M.S.K. (Institute of Theoretical Science, University of Oregon, Eugene, Oregon 97403). Phys. Rev. D 10: No. 9, 3119-3123 (1 Nov 1974).

Based on assumptions suggested by the experimental data we examine the ratios of the nucleon structure functions using the framework of (i) the ratio $(F_2^{en}/F_2^{ep}) \le 1$; (ii) $0 \le R_3 = F_3^{\nu p}/F_2^{\nu n} \le 1, 0 \le R_3 = F_3^{\nu p}/F_3^{\nu n} \le 1$; (iii) at threshold, $R_2 = R_3 = 0$, $R = (F_2^{ep} + F_2^{en})/(F_2^{ep} + F_2^{en}) = 18/5$ and $F_2 = 2F_1 = |F_3|$. (auth)

12604 INELASTIC ELECTRON SCATTERING IN THE QUARK MODEL AND IN THE QUARK-DIQUARK MODEL. Ono, S. (Department of Physics, University of Tokyo, Tokyo, Japan). Phys. Rev. D 10: No. 9, 3124-3127 (1 Nov 1974).

An extended version of an earlier model where the electroproduction processes were calculated using a modified Woods-Saxon potential in the quark model and in the quark-diquark model is presented in this paper. The dependence of the cross section on the quark mass is investigated and the ratio $R = \sigma_L/\sigma_T$ is calculated.

12605 REMARKS ON THE BOUNDS OF THE PION FORM FACTOR. Bonneau, G. (Laboratoire de Physique et Hautes Energies, Université Paris VI, 4, place Jussieu, 75230 Paris Cedex 05, France); Grunberg, G.; Martin, F.; Pham, T.N.; Truong, T.N. Phys. Rev. D 10: No. 9, 3136-3138 (1 Nov 1974).

A rigorous proof of the known bounds on the spacelike pion form factor is given. From this, an average lower bound for the timelike pion form factor $|F(t)|$ above $t = 2\ GeV^2$ is given. This result implies essentially that $|F(t)|$ cannot decrease faster on the average than $\text{const}/t^{1.2\pm0.3}$. (auth)

12606 FIXED-t DISPERSION SUM-RULE INEQUALITIES FOR COMPTON SCATTERING. Guiaşu, I.; Radescu, E.E. (Institute for Atomic Physics, P. O. Box 35, Bucharest, Romania). Phys. Rev. D 10: No. 9, 3036-3043 (1 Nov 1974).

Fixed-momentum-transfer dispersion relations for Compton scattering on spin-0 and spin-1/2 targets, involving the moduli of the amplitudes rather than their imaginary parts, are written down and subsequently converted into model-independent sum-rule inequalities for the unpolarized differential cross section. (auth)

12607 CONSISTENCY OF SCALING WITH UNITARITY. Patrascioiu, A. (The Institute for Advanced Study, Princeton, New Jersey 08540). Phys. Rev. D 10: No. 9, 2943-2950 (1 Nov 1974).

Unitary is used to derive the analyticity properties of the cross section for electroproduction and inclusive $e^- + e^+$ annihilation in the Bjorken limit. It is found that both cross sections contain anomalous singularities in the scaling variable ω. The ones in electroproduction are of higher-order electromagnetic strength and thus are negligible. The asymptotic behavior of anomalous singularities in inclusive $e^- + e^+$ annihilation is investigated in the nonperturbative parton model. It is found that they survive asymptotically only if the model contains massless gluon fields, but otherwise are of vanishing strength in the scaling limit. (auth)

12608 CONNECTION BETWEEN BRANCHING PROCESSES AND SCALE-INVARIANT FIELD THEORY FOR e^+e^- ANNIHILATION. Orfanidis, S.J.; Rittenberg, V. (Rockefeller University, New York, New York 10021). Phys. Rev. D 10: No. 9, 2892-2903 (1 Nov 1974).

Branching-process models for e^+e^- annihilation give the same moment sum rules for the one-particle inclusive spectrum as those obtained in scale-invariant theories. In such models the one-particle inclusive spectrum is computed explicitly at high energies and is shown to be Gaussian in a variable which is the analog of rapidity in hadronic reactions. Two-particle correlations, exclusive cross sections, and prong cross sections are discussed and definite predictions are obtained. (auth)

12609 HEAVY-NEUTRAL-LEPTON PRODUCTION IN ELECTRON-POSITRON COLLIDING-BEAM EXPERIMENTS. Ali, A. (Physics Department, Stevens Institute of Technology, Hoboken, New Jersey 07030). Phys. Rev. D 10: No. 9, 2801-2809 (1 Nov 1974).

We present possible mechanisms for single and pair heavy–neutral–lepton production in electron–positron colliding–beam experiments for the general class of gauge models involving these leptons. We have calculated the cross sections for the processes $e^+e^- \to E^0\bar{E}^0$, $e^+e^- \to M^0\bar{M}^0$, $e^+e^- \to \bar{M}^0\nu_\mu$, $e^+e^- \to \bar{E}^0\nu_e$, and $e^+e^- \to \mu^+\mu^-$ in all such models. Specific results that obtain in the Georgi–Glashow model and the Beg–Zee version of the SU(2) ⊗ U(1) model are also presented. The process $e^+e^- \to E^0\bar{E}^0$ turns out to be a dominant mode in the e^+e^- annihilation experiments, in the Georgi–Glashow model, if the W boson is not very heavy. (auth)

12610 HADRON PRODUCTION IN ELECTRON–ELECTRON SCATTERING. Chen, M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 10: No. 9, 2809-2816 (1 Nov 1974).

The total and single–hadron inclusive cross sections and energy, momentum, and multiplicity distributions from the two–photon process in electron–electron scattering are estimated from the photon–hadron analogy and Regge behavior. Corrections to this estimation and the possible relationships between the electron–electron and electron-positron cross sections are discussed. (auth)

12611 MULTIVARIATE LEAST SQUARES FITTING PROGRAM USING MODIFIED GRAM-SCHMIDT TRANSFORMATIONS. O'Connell, M. J. (Science Research Council, Chilton (UK). Rutherford Lab.). Comput. Phys. Commun.; 8: No. 1, 56-69(Aug 1974).

The program is used for fitting a dependent variable in terms of functions of many independent variables, e.g. finding the momentum of a charged particle from observation of its trajectory in a magnetic field. The residual sum of squares is minimized using modified Gram-Schmidt orthogonal basis vectors. (auth)

12612 HYDRODYNAMICAL APPROACH TO THE ELECTRON-POSITRON ANNIHILATION INTO HADRONS. Feinberg, E. L. (AN SSSR, Moscow. Fizicheskij Inst.). Phys. Lett., B; 52: No. 2, 203-206(30 Sep 1974).

The problem is reconsidered and it stressed that viscosity must be taken into account. This makes superfluous introduction of an "initial hadronic volume" $V_0 \sim m_\pi^{-1}$ which in the e^+e^- case can hardly be physically motivated. The viscosity becomes the single source of dissipation. A rough estimate of multiplicity is presented. Further, blackbody electromagnetic radiation from the hot hadronic clump turns out to be essential. It leads to an increase of energy spent on the neutral component. (auth)

12613 FINAL-STATE INTERACTIONS IN RADIATIVE PRODUCTION OF PIONS IN COLLIDING-BEAM EXPERIMENTS. Izquierdo, J. M. (Junta de Energia Nuclear, Madrid (Spain)); Yndurain, F. J. (Universidad Autonoma de Madrid (Spain)). Phys. Lett., B; 52: No. 2, 223-226(30 Sep 1974).

The contribution of final state interactions of the pions in the process $e^+e^- \to \pi\pi\gamma$ is calculated. It is noted that this may be used to obtain the zero isospin $\pi\pi$ s-wave in the ϵ-region, or if knowledge of this wave is assumed, to obtain a good estimate of the background for $e^+e^- \to \pi\pi$. (auth)

12614 DETERMINATION OF RESONANCE COUPLINGS AND HIGH ENERGY AMPLITUDES IN $\gamma N \to \pi N$ USING FIXED-t DISPERSION RELATIONS. Devenish, R. C. E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)); Lyth, D. H. (Lancaster Univ. (UK)); Rankin, W. A. (Bonn Univ. (F. R. Germany). Physikalisches Inst.). Phys. Lett., B; 52: No. 2, 227-232(30 Sep 1974).

The real parts of the amplitudes are generated entirely from their imaginary parts via the d.rs., and essentially all available data are included at all energies with momentum transfer $|t| < 1$ GeV^2. A total of 46 resonance couplings and 50 high energy parameters are varied to fit all the data simultaneously with a χ^2 of 4.8 per data point. (auth)

12615 TESTS OF SCALING OF THE PROTON ELECTROMAGNETIC STRUCTURE FUNCTIONS. Riordan, E. M.; Bodek, A.; Breidenbach, M.; Dubin, D. L.; Elias, J. E.; Friedman, J. I.; Kendall, H. W.; Poucher, J. S.; Sogard, M. R. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics); Coward, D. H. (Stanford Linear Accelerator Center, Calif. (USA)). Phys. Lett., B; 52: No. 2, 249-252(30 Sep 1974).

Deep-inelastic structure functions W_1 and W_2 were extracted from electron–proton scattering cross sections that were measured in recent experiments at SLAC. The structure functions display deviations from scaling in the variable ω in the kinetic range $1.5 \le \omega \le 3.0$ and $2 \le Q^2 \le 15$ GeV^2. (auth)

Weak

Refer also to abstract 12693.

12616 DEEP INELASTIC NEUTRINO–NUCLEON CROSS SECTION. Pal, B. K. (Imperial Coll. of Science and Tech., London). Lett. Nuovo Cim.; 11: No. 14, 613-616(7 Dec 1974).

From the empirical facts of the structure functions, an attempt is made to obtain the quark number density functions in analytic form. These are evaluated accurately from the probability constraints together with neutrino data. Except for the assumption of the analytic forms for the parton distribution functions, the results predicted are entirely model independent. (JFP)

12617 EXPERIMENTS ON WEAK INTERACTIONS AT HIGH ENERGIES. Myatt, G. (Oxford Univ.). Acta Phys. Pol., B5: No. 6, 799-837(1974).

In these lectures one discusses recent experiments on deep inelastic neutrino processes, quasi-elastic reactions, and neutral currents. (auth)

12618 TENSOR CONSTANTS OF AXIAL-VECTOR WEAK CURRENTS OF HYPERON β-DECAY. Krive, I. V. (Kharkov State Univ.). Yadern. Fiz.; 20: No. 3, 614-616(Sep 1974). (In Russian).

The axial-vector tensor constants were evaluated by superselection dispersion sum rules and the results obtained were compared with available experimental data. The tabulated calculated values agree with experimental data although a small change in the parameter f in the region $f \simeq 0.20$ to 0.25 brings $g_2(\Sigma^- \to n)$ into agreement with experimental values and significantly improves the agreement of calculated and experimental data for $g_2(\Lambda \to p)$. (JSR)

12619 COMPOSITE MODELS OF LEPTONS. Greenberg, O.W. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Nelson, C.A. Phys. Rev. D 10: No. 8, 2567-2573 (15 Oct 1974).

We give ten criteria for composite models of leptons, and present two models which satisfy a number of these criteria. Both models use three triplets of leptonic analogs of quarks which we call "leptoquarks"; the first model uses fractionally charged leptoquarks and the second model uses integrally charged ones. In the second model, leptoquarks and quarks could be identical and there is a possibility of unifying the description of leptonic and hadronic phenomena. Both models assign leptons to nonsinglet representations of SU(3)". A plausible SU(3)" mass formula allows the known leptons to be less massive than baryons if leptoquarks and quarks are identical. (auth)

12620 ALLOMORPHIC CORRECTIONS TO SEMILEPTONIC PROCESSES. Duncan, A. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts). Phys. Rev. D 10: No. 8, 2619-2646 (15 Oct 1974).

The notion of allomorphic corrections to S–matrix elements for semileptonic processes, which by definition are absent in the lowest nontrivial order of perturbation theory, is introduced and analyzed. The complete fourth–order allomorphic corrections to the leptonic weak currents are calculated in an arbitrary gauge model of weak and electromagnetic interactions, treating the strong interactions (assumed mediated purely by gauge vector gluons) to all orders. These results are used to analyze the induced leptonic pseudoscalar current in charged–pion decay, and it is shown that weak restrictions on particle masses suffice to preserve the V–A structure at the leptonic vertex to $O(\alpha G_F)$. A preliminary discussion of the allomorphic corrections to hadronic weak currents is presented in the context of neutral–kaon decay ($K^0 \to \mu^-\mu^+$). It is shown that in theories in which the kaon field dimensionality is two or less, the usual suppression mechanisms involving charmed quarks probably do not suffice to remove induced neutral, strangeness–changing currents in $O(\alpha G_F)$. (auth)

12621 UNIVERSAL FERMI INTERACTION. Hock, G. ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 3, 193-206(1974). (In Hungarian).

The basic idea is to review the strangeness conserving universal Fermi interaction. The fundamentals inherent in the weak processes in question for pedestrians are outlined. On this occasion weak interactions of "bare" and "dressed" nucleons are dealt with on the proper level. (auth)

12622 A "CABIBBO" THEORY FOR LEPTONS AND THE NEUTRINO MASSES. Eliezer, S.; Ross, D.A. (Physics Department, Imperial College, London SW7, England). Phys. Rev. D 10: No. 9, 3088-3092 (1 Nov 1974).

We suggest a complete analogy between the lepton current and the Cabibbo theory for hadronic weak interactions. Both neutrinos couple to both the muon and the electron, so at least one of the neutrinos is required to be massive. The two neutrinos have the same type of interactions and are distinguishable only by their masses, like the muon and the electron. In this theory muon number (or electron number) may be violated. All possible types of such processes are considered. In

particular $\mu \rightarrow e\gamma$ and the decay of the more massive neutrino, $\nu_\mu \rightarrow \nu_e\gamma$, are calculated in detail. We find a lifetime for ν_μ larger than 1.5 $\times 10^{-3}$ sec. (auth)

12623 W⁰ EFFECTS IN BHABHA SCATTERING AND BEAM POLARIZATION. Budny, R. (Institute of Theoretical Physics, Department of Physics, Stanford University, Stanford, California 94305); McDonald, A. Phys. Rev. D 10: No. 9, 3107-3109 (1 Nov 1974).

An analysis is given of the reaction $e^+e^- \rightarrow e^+e^-$ for arbitrarily polarized beams, assuming the existence of a neutral weak current. It is found that longitudinally polarized beams afford the best prospect of measuring weak–interaction effects in this process. (auth)

12624 REGGE ANALYSIS OF DEEP–INELASTIC LEPTON–NUCLEON SCATTERING. Bajpai, R.P.; Mukherjee, S. (Department of Physics, Center for Postgraduate Studies, Himachal Pradesh University, Simla–171001, India). Phys. Rev. D 10: No. 9, 3044-3047 (1 Nov 1974).

The asymptotic behavior of the structure functions $F_2^{ep}(x)$ and $F_2^{vp}(x)$ is studied in a quark–parton model. It is shown that the structure functions have the expected Regge behavior. The calculated Regge residues agree well with those obtained from pion–nucleon cross sections by an extrapolation in Q^2 via a weak form of generalized scaling. The total photoabsorption cross section is also reproduced in this scheme, once the over–all scale is fixed. (auth)

12625 OCTET DOMINANCE IN HYPERON DECAYS. Bajaj, J.K.; Kaushal, V.; Khanna, M.P. (Department of Physics, Panjab University, Chandigarh, India). Phys. Rev. D 10: No. 9, 3076-3080 (1 Nov 1974).

Expanding the hyperon decay transition amplitudes in terms of the eigenamplitudes of the direct channel and assuming that only the eigenamplitudes corresponding to physical particle states can contribute to the transitions, we are led to the hypothesis of octet dominance. This assumption also yields a few extra relations for s– and p–wave amplitudes which compare favorably with experiments. (auth)

12626 ANALYSIS OF SOME OBSERVABLE EFFECTS OF WEAK NEUTRAL CURRENTS COUPLED TO CHARGED LEPTONS. Patil, R.S.; Patil, S.H.; Rindani, S.D. (Physics Department, Indian Institute of Technology, Bombay–76, India). Phys. Rev. D 10: No. 9, 3070-3075 (1 Nov 1974).

We have analyzed the parity–violating effects in the process $e + \bar{e} \rightarrow k_1 + k_2 + X$, $k_1 + k_2 \rightarrow e + \bar{e} + X$, and $e + k_1 \rightarrow e + k_2 + X$, where e, $\bar{e}$ are the electron, positron states, k_1, k_2 are the hadron states, and X is the inclusive hadron state, due to the possible coupling of weak neutral currents to charged leptons. We estimate that for gauge theories of the weak interaction, the parity–violating asymmetry parameter for the distribution in $e + \bar{e} \rightarrow \pi^+ + \pi^- + \pi^0$ may be of the order of 5% in the resonance region of the A_1 meson and experimentally observable. (auth)

12627 NEUTRINO REACTIONS IN DEUTERIUM IN THE ELEMENTARY–PARTICLE MODEL AND THE AXIAL–VECTOR–CURRENT FORM FACTOR. Mintz, S.L. (Center for Theoretical Studies, University of Miami, Coral Gables, Florida 33124). Phys. Rev. D 10: No. 9, 3017-3021 (1 Nov 1974).

The differential cross sections for the reactions $\nu_\mu + d \rightarrow p + p + \mu^-$ and $\bar{\nu}_e + d \rightarrow n + n + e^+$ are calculated in the forward direction from threshold to $E_\nu = 10$ GeV. The differential cross sections are found to be of the form $d\sigma/d\Omega = \beta\,(E_\nu)E_\nu^2$, where $\beta\,(E_\nu)$ is a slowly increasing function. It is shown that most of the contributions to $d\sigma/d\Omega$ come from the region of small q^2 and that to a good approximation $F_A(q^2 \sim 0)$ can be obtained from $d\sigma/d\Omega$ at large E_ν. (auth)

12628 SCALING DEVIATIONS FOR NEUTRINO REACTIONS IN ASYMPTOTICALLY FREE FIELD THEORIES. Zee, A.; Wilczek, F.; Treiman, S.B. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 10: No. 9, 2881-2891 (1 Nov 1974).

Several aspects of deep–inelastic neutrino scattering are discussed in the framework of asymptotically free field theories. We first consider the growth behavior of the total cross sections at large energies. Because of the deviations from strict scaling which are characteristic of such theories the growth need not be linear. However, upper and lower bounds are established which rather closely bracket a linear growth. We next consider in more detail the expected pattern of scaling deviation for the structure functions and, correspondingly, for the differential cross sections. The analysis here is based on certain speculative assumptions. The focus is on qualitative effects of scaling breakdown as they may show up in the x and y distributions. The last section of the paper deals with deviations from the Callan–Gross relation. (auth)

12629 EFFECT OF NEUTRAL WEAK CURRENT IN THE DECAY $\Sigma^0 \rightarrow \Lambda^0 + e^+e^-$ IN WEINBERG'S MODEL. Mani, H.S.; Sharatchandra, H.S. (Department of Physics, Indian Institute of Technology, Kanpur 208016, India). Phys. Rev. D 10: No. 9, 2849-2852 (1 Nov 1974).

Weinberg's model of weak and electromagnetic interaction predicts a longitudinal polarization of Λ^0 in the decay $\Sigma^0 \rightarrow \Lambda^0 + e^+e^-$ which can be calculated uniquely, in terms of the Weinberg angle. The polarization of Λ^0 is in general of the order of 10^{-3}. However, for small $|\vec{p}_\Lambda|$ (Λ^0 momentum) $\simeq 10^{-2}$ MeV, the polarization is large and is $\simeq 0.1\%$ for the Weinberg angle $\theta_w \simeq 35°$. The width of the peak where the polarization is large, is narrow and is in the region where the number of events expected are small. (auth)

12630 RESTRICTIONS ON AXIAL–VECTOR SECOND–CLASS CURRENTS FROM BARYON SEMILEPTONIC–DECAY DATA. García, A. (Departamento de Física, Centro de Investigación y Estudios Avanzados del Instituto Politecnico Nacional, Apartado Postal 14–740, México 14, D. F.). Phys. Rev. D 10: No. 9, 2839-2848 (1 Nov 1974).

In a previous analysis we found that in order to improve the agreement between Cabibbo's model and the present data in hyperon β decays, strong symmetry–breaking corrections seem to be required. This was manifested through large pseudotensor form factors. In the present paper we investigate whether these large form factors can be generated by second–class currents. We study the question of extending the Cabibbo's–model universality to second–class currents and how good an approximation the symmetry limit can be. (auth)

Strong (General)

Refer also to abstracts 12695 and 13072.

12631 (JINR-E2-8088) PRIMITIVE REPRESENTATIONS OF THE ALGEBRA SL(3, R). Ogievetskii, V. I.; Sokatchev, E. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

The unitary irreducible representations of the SL(3, R) algebra are investigated, which contain every irreducible representation of its maximal compact subalgebra SO(3) not more than once. (auth)

12632 HIGH TRANSVERSE MOMENTUM HADRON–HADRON COLLISIONS. Bjorken, J. D. (Stanford Linear Accelerator Center, CA). Acta Phys. Pol., B5: No. 6, 893-906(1974).

Some theoretical aspects of the subject of high $p_\perp$ hadron production in strong interactions are discussed. This includes properties of inclusive spectra, the parent-child relation and its applications to direct lepton and γ-ray production. Also discussed are hypotheses regarding the phase-space populations of associated particles, correlations and production of jets. Dynamical models are only very briefly discussed, and suggestions for future experimentation are listed. (auth)

12633 GEOMETRICAL INTERPRETATION OF HADRONIC COLLISION AT HIGH ENERGY. Cecchet, G.; Dolfini, R.; Impellizzeri, F. (Univ., Pavia, Italy). Lett. Nuovo Cim.; 11: No. 14, 622-626(7 Dec 1974).

A geometrical interpretation of hadronic collisions at high energies is presented. The probability distribution for particle production and the topological cross sections are discussed. (JFP)

12634 FEW REMARKS ABOUT HADRON RESONANCE AND THEIR EFFECTS IN HADRONIC ATOMS. Wrzecionko, J.; Wycech, S. (Inst. for Nuclear Research, Warsaw). Czech. J. Phys.; 24: No. 11, 1293-1304(1974).

Interactions of antikaons, antiprotons and nucleons at very low energies are discussed in terms of separable potential models. Coulomb interactions are included and formulas for strong shifts of electromagnetic hadronic hydrogen are obtained. These are discussed as a way of determination of scattering amplitudes below thresholds. Applications to hadronic deuterium are mentioned. (auth)

12635 ON-SHELL FADDEEV EQUATIONS: A DEMOCRITEAN APPROACH TO THE THREE-BODY PROBLEM. Noyes, H. P. (Stanford Univ., CA). Czech. J. Phys.; 24: No. 11, 1205-1215 (1974).

Coupling the mass-energy relation $\delta E \geq mc^2$ to the uncertainty relation $\delta E \delta t \geq \hbar$ produces fluctuations in the number of particles at short distances and scatterings of particle pairs independent of any specific "interaction" mechanism. This observation allows the construction of a scattering theory in which there are only particles and the void, but particle number can change. A system of three massive particles (hadrons) in the energy region below the first production threshold for a fourth hadron and above the first anomalous threshold for the presence of a fourth "virtual" hadron is considered. The on-shell Faddeev equations, containing only two-particle scattering phases for positive two particle energies, provide a convergent, unitary, and readily soluble

dynamics for this system. If any of the pairs can coalesce into a different particle with a rest energy less than the sum of the rest energies of the pair, the equations can be readily extended to describe 3–2 and 2–3 transitions involving this particle (coalescence, breakup) elastic scattering from it, and if there is more than one such particle 2–2 rearrangements. The three-body "bound state" requires a well defined analytic continuation. Features of more conventional calculations of three-nucleon problems which provide examples of this structure are discussed. Since only free particles occur in the theory, and the only failure of energy conservation is that required by the uncertainty principle for (free-particle) intermediate states, these one-variable equations might be extended to particles with the relativistic connection between mass, energy and momentum, and transitions in which the full rest energy of the particle which appears or disappears must be provided. The nonlinear "crossed" theory for such particles was not written down, but if the relativistic boundary condition model of Brayshaw is viewed as representing these crossed processes by a phenomenological core, then a crossed theory requiring the π to be a bound state of three π's might predict the $\pi-\pi$ S-wave scattering length in the I = 0 state in terms of the pion Compton wavelength (and hence the position and the width of the Q) and will then show that the Q in turn generates a single ω resonance at about the right place. Implications are discussed. (auth)

12636 ELEMENTARY AND COMPOSITE PARTICLES IN ASYMPTOTICALLY FREE GAUGE THEORIES. Cheng, T.P. (Department of Physics, University of Missouri—St. Louis, St. Louis, Missouri 63121); Ng, W.; Young, K. Phys. Rev. D 10: No. 8, 2459-2464 (15 Oct 1974).

We demonstrate that in asymptotically free gauge theories the wave–function renormalization constants for spin–1/2 fields do not vanish. The scalar fields, if incorporated, also have this property. However, there exists a subclass of such theories where the Z's for the gauge fields themselves tend to zero in the limit of infinite cutoff. These features are shown to be gauge–independent. This suggests the potentiality of constructing asymptotically free strong–interaction theories in which the only elementary fields are "quarks" and all other hadrons are bound states. (auth)

12637 CONFINEMENT OF QUARKS. Wilson, K.G. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14850). Phys. Rev. D 10: No. 8, 2445-2459 (15 Oct 1974).

A mechanism for total confinement of quarks, similar to that of Schwinger, is defined which requires the existence of Abelian or non–Abelian gauge fields. It is shown how to quantize a gauge field theory on a discrete lattice in Euclidean space–time, preserving exact gauge invariance and treating the gauge fields as angular variables (which makes a gauge–fixing term unnecessary). The lattice gauge theory has a computable strong–coupling limit; in this limit the binding mechanism applies and there are no free quarks. There is unfortunately no Lorentz (or Euclidean) invariance in the strong–coupling limit. The strong–coupling expansion involves sums over all quark paths and sums over all surfaces (on the lattice) joining quark paths. This structure is reminiscent of relativistic string models of hadrons. (auth)

12638 THRESHOLD SINGULARITIES AND GRIBOV'S REGGEON CALCULUS. Hayot, F. (Department of Physics, University of Michigan, Ann Arbon, Michigan 48104). Phys. Rev. D 10: No. 8, 2691-2693 (15 Oct 1974).

Within the framework of Gribov's Reggeon calculus we study the influence of the two–pion threshold on the Pomeron trajectory. We point out that in order to obtain a physically meaningful result, it is important to know which Reggeon–Reggeon–particle–particle partial–wave amplitudes can be taken to be constants. (auth)

12639 FUNCTIONAL APPROACH TO STRONG–COUPLING THEORY IN STATIC MODELS. II. GENERAL CASE. Branco, G.C.; Sakita, B.; Senjanovic, P. (Department of Physics, City College of the City University of New York, New York, New York 10031). Phys. Rev. D 10: No. 8, 2582-2587 (15 Oct 1974).

The functional approach to strong–coupling theory is extended to the general case. The necessary mathematical techniques are discussed. Properties of the matrix Λ_{DE} which appears in scattering amplitudes are analyzed. (auth)

12640 CANONICAL TRANSFORMS BETWEEN "CURRENT" AND "CONSTITUENT" QUARKS. Palmer, W.F.; Rabl, V. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. D 10: No. 8, 2554-2566 (15 Oct 1974).

Certain transforms recently and not so recently proposed to convert current algebras into Hamiltonian symmetries are studied in the quark model with particular attention to their Fock–space properties. Expectation values and probability amplitudes are calculated which unveil the structure of a "current" quark in terms of a "constituent" quark. It is questioned whether these distributions admit a parton interpretation. (auth)

12641 HIGGS MECHANISM AND QUARK CONFINEMENT. Creutz, M. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. D 10: No. 8, 2696-2699 (15 Oct 1974).

We discuss a recently proposed mechanism for quark confinement obtained by combining the Higgs mechanism for producing massive gauge mesons with the theory of magnetic monopoles. The theory is mathematically equivalent to the quarks being magnetic monopoles moving in a superconducting vacuum. When the quarks in a hadron are pulled apart, they remain connected by vortices of magnetic flux; consequently, at large interquark distances the energy of the system becomes proportional to the quark separation. At low energies the quarks are closer together than the penetration depth of the superconductor, and thus they appear effectively free. (auth)

12642 NEW MULTIPERIPHERAL MODEL WITH IDENTICAL CLUSTERS: COHERENT SUMMATION OVER ALL CRISSCROSS GRAPHS. Matsson, L. (Institute of Theoretical Physics, Fack 1, S–402 20 Göteborg 5, Sweden). Phys. Rev. D 10: No. 8, 2663-2669 (15 Oct 1974).

A new multiperipheral model with identical clusters is suggested. We thereby coherently sum over all crisscross diagrams, which is made possible by our earlier suggested correlation expansion–a rearrangement of the ordinary perturbation expansion. This shows that there are dynamical correlations already in the simple multiperipheral structure. Finally, we demonstrate that the first term in this expansion, which is equal to the eikonal part of our generalized multiperipheral model, describes the bound–state structure and exhibits Regge behavior. (auth)

12643 SPONTANEOUS SYMMETRY BREAKING IN THE O(N) MODEL FOR LARGE N. Coleman, S. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts); Jackiw, R.; Politzer, H.D. Phys. Rev. D 10: No. 8, 2491-2499 (15 Oct 1974).

We study the O(N) generalization of the σ model in the limit of large N, for four, three, two, and one space–time dimensions. We compute the effective potential and some momentum–dependent Green's functions. In one and two dimensions, spontaneous symmetry breakdown is impossible; any asymmetric minimum inserted in the tree–approximation potential is immediately filled in by the effects of radiative corrections. This is in agreement with general theorems. In four dimensions, the model is inconsistent; it possesses a tachyon. In three dimensions, the model seems to be consistent, and offers an interesting example of some nonlinear effects associated with spontaneous symmetry breakdown that are not present in the usual tree–approximation models. (auth)

12644 ON COMPLETE SETS IN THE RELATIVISTIC LADDER SCHEME OF THE HADRON CLASSIFICATION. Nikolov, A. V. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). Compt. Rend. Acad. Bulg. Sci.; 26: No. 5, 611-613(1973). (In Russian).

The generalized complete set consists of two parts: the first contains the momenta P^μ and the second is covariant (with respect to the Lorentz group), and it is relativistic generalization of the ladder complete set consisting from the operators (1) B, n, Y, Z, I_3, I^2, J^2, K^2, L^2, N^2, S^2. These operators form a complete set in the physical space, whose elements are $T = \{T^a_b(P^\mu), a = (a_1, \ldots, a_p), b = (b_1, \ldots, b_q), p,q = 1,2, \ldots, a_i b_i = 1, \ldots, 6\}$. It is proved that the operators l^2 and l_3 together with the system form a complete set in the physical space and each its subspace H_m. Each subspace H_m defines a hadron with a mass m. The operators l^2 and l_3 are introduced as follows: $l_k = \frac{1}{2} \Sigma^3_{i,j=1} \epsilon_{kij} L^{ij}$, k = 1, 2, 3 where $L^{\mu\nu}$ are ordinary angular four-momenta. An additional parity, connected with the operator Z is introduced. (auth)

12645 ON GENERAL ENUNCIATION OF DROPLET MODEL OF HADRON DIFFRACTION. Potupa, A. S. (AN Belorusskoj SSR, Minsk. Inst. Fiziki). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 107-111(1972). (In Russian).

A quantum mechanical picture of the elastic scattering of extended hadrons in the high energy range was constructed generalizing the Chow-Yang droplet model. The relation between the quasielastic channel of diffraction excitation and the spectra of hadron states was discussed on the basis of an oscillator set of internal degrees of freedom. (tr-auth)

12646 COMMENTS ON A NEW SCALING HYPOTHESIS IN HIGH–ENERGY COLLISIONS. Lichtenberg, D.B. (Physics Department, Indiana University, Bloomington, Indiana 47401). Phys. Rev. Lett. 33: No. 25, 1520-1521 (16 Dec 1974).

Dao et al. have demonstrated that single–particle distributions in inclusive reactions scale in a new variable. We comment on the nature of the scaling relation satisfied and note that their parametrization of the single–particle distributions requires only two parameters rather than the six they used. (auth)

12647 DIP LOCATION IN HIGH–ENERGY SCATTERING. Kuroda, M. (Department of Physics, University of Tokyo, Tokyo, Japan). Phys. Rev. D 10: No. 9, 3132-3135 (1 Nov 1974).

Based on a composite picture of hadrons, the high–energy behavior of the dip location in elastic scattering amplitudes is investigated. The

dip location is governed by the number and the size of constituents inside the hadron as well as the size of the hadron itself. The dip position is predicted to shift very slightly for a change of s from s = 2700 GeV² to 22000 GeV². (auth)

12648 FACTORIZABLE MODEL FOR MASSIVE CURRENT PROCESSES. Bander, M.; Rangachari, M. (Department of Physics, University of California, Irvine, Irvine, California 92664). Phys. Rev. D 10: No. 9, 3081-3087 (1 Nov 1974).

On the basis of intuition and experience obtained in applying multiperipheral models to hadronic processes we generalize these ideas and techniques to massive current reactions. The details of the exchanges and cutoffs are not important and most of our results depend only on factorization properties of these amplitudes. A relation for the structure functions of the various current processes is obtained. A comparison is made to other models for these hard–current reactions. (auth)

12649 TRIPLE–REGGE COUPLING AND THE MULTIPERIPHERAL OR MUELLER–REGGE MODEL. Snider, D.R. (Department of Physics, University of Wisconsin–Milwaukee, Milwaukee, Wisconsin 53201). Phys. Rev. D 10: No. 9, 3105-3106 (1 Nov 1974).

In the pole approximation the Mueller–Regge and multiperipheral models have been shown to be equivalent. The couplings in the two forms are related by a transformation by a particular orthogonal matrix. This same matrix and the above couplings also yield the triple–Regge coupling constants. (auth)

12650 EFFECTS OF DIFFRACTIVE CHANNELS ON HADRONIC CROSS SECTIONS. Fishbane, P.M.; Schaffner, J.G.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 10: No. 9, 3056-3067 (1 Nov 1974).

We consider the effects of diffractive channels on total, elastic, and diffractive cross sections in a model in which an elementary particle scatters on a composite system of A constituents. We find that the effect of diffractive channels is to lower σ_{el}/σ_T below the value it would have were no diffractive channels present. We find both σ_{el}/σ_T and $(\sigma_{el} + \sigma_{diff})/\sigma_T \leq 1/2$. In the limit $A \to \infty$, we find $\sigma_{el}/\sigma_T \to 1/2$ and $\sigma_{diff}/\sigma_T \to 0$, for both the optical and the overlap cases discussed in the text. (auth)

12651 UNIFIED DESCRIPTION OF INCLUSIVE AND EXCLUSIVE REACTIONS AT ALL MOMENTUM TRANSFERS. Blankenbecler, R.; Brodsky, S.J. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 10: No. 9, 2973-2992 (1 Nov 1974).

The constituent–interchange model is used to relate large– and small–momentum–transfer reactions, to relate inclusive and exclusive processes, and to predict the form of the inclusive cross section throughout the Peyrou plot. Two important corrections to the triple–Regge formula are derived. The first, important at a small missing mass, allows a smooth connection to exclusive processes. The second, important at large missing mass, allows a smooth connection to the central region and to the large–transverse–momentum regime. Simple quark–counting rules are given which predict the limiting behavior of Regge trajectories and residue functions, and also the powers of P_T^2 and the missing–mass dependence of inclusive cross sections. Many experimental consequences of the model are given. (auth)

12652 RISING TOTAL CROSS SECTIONS AND AMPLITUDES AT LARGE IMPACT PARAMETER FROM s– AND t–CHANNEL UNITARITY. Pumplin, J. (Physics Department, Michigan State University, East Lansing, Michigan 48824); Henyey, F.; Kane, G.L. Phys. Rev. D 10: No. 9, 2918-2921 (1 Nov 1974).

Production processes which involve pion exchange at large impact parameter cause a rise in σ_T, an increased slope of $d\sigma/dt$ near $t = 0$, and shrinkage of the forward slope with energy. The remarkably high energy–scale for the rise in σ_T, $s_0 \simeq m^2m'^2/m_\pi^2$, follows from the kinematical opening of phase space near the pion pole. The magnitude is determined by known coupling constants. The effects are due to two–pion–exchange cut terms in the imaginary part of the elastic amplitude, and therefore involve both s– and t–channel unitarity. (auth)

12653 UNIVERSALITY OF HADRON FORM FACTORS ABSTRACTED FROM THE PARTON MODEL. Goldberg, H. (Department of Physics, Northeastern University, Boston, Massachusetts 02115 and Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). Phys. Rev. D 10: No. 9, 2922-2933 (1 Nov 1974).

The role played by the orbital angular momentum L_z in parton models at $p = \infty$ is delineated. By postulating similar behavior for the parton wave functions of the low–lying baryons of equal L_z, we are able to relate various of the transition form factors for $\gamma_V N \to N^*$ to the elastic form factors of the nucleon. (auth)

Strong (Baryon No. = 0)

12654 (HU-TFT-74-15) DIFFRACTIVE AND NON DIFFRACTIVE PION PRODUCTION ON DEUTERON. Alberi, G.; Rosa, L. P. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Jun 1974. 40p. Dep. NTIS (US Sales Only) $5.00.

An ensemble of formulas for the calculation of the Glauber correction to the incoherent production on deuteron is presented. The formulas are written in terms of phases, slopes and integrated cross sections and both the diffractive and nondiffractive case are considered. It is shown in the case $K^+ \to K^0\pi^+$, that only if the analysis is done in such a way that the final set of states is complete, there is agreement between theory and experiment. (auth)

12655 (JINR-E1-8065) DETERMINATION OF THE DEGREE OF THE $\Delta I = 1/2$ RULE VIOLATION AND THE ESTIMATION OF THE S-WAVE PION–PION SCATTERING LENGTHS FROM THE DATA ON $K \to 3\pi$ DECAYS. Bunyatov, S. A.; Volkovitskii, P. E.; Gulkanyan, G. R. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

The analysis is given of experimental data on $K \to 3\pi$ decays which is based on the semi-phenomenological theory of three strong-interacting particle production near threshold. The contribution of $\Delta I = 3/2$ transition to the amplitudes partial widths and pion spectra of various $K \to 3\pi$ decay modes was determined. The allowed values for the s-wave pion–pion scattering lengths a_0 and a_2 in the isotopic states I = 0 and I = 2 were obtained. (auth)

12656 (JINR-P2-8069) CORRELATIONS BETWEEN THE PARTICLES WHICH HAVE SMALL RELATIVE MOMENTA. Kopylov, G. I.; Lyuboshitz, V. L.; Podgoretskii, M. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Some general properties of inclusive two-particle structure functions are studied. The structure functions of $\pi^+\pi^+$, $\pi^+\pi^0$ etc. pairs are expressed in terms of the structure functions corresponding to the total isospin of the meson pairs. The limiting case $\tilde{q} = \tilde{p}_1 - \tilde{p}_2 \to 0$ (where $\tilde{p}_1$, $\tilde{p}_2$ are momenta of two particles) is studied in detail. The consequences of general formula for the statistical model of multiple production are presented. The spin effects are considered. The speed of vanishing the odd orbital momenta states, when $\tilde{q} \to 0$, is studied. This speed is determined by the dimensions of the meson-producing region. The result obtained is valid also for the resonant production of particles with small relative momenta. (auth)

12657 IS THE 3104-MeV VECTOR MESON THE ϕ_C OR THE W_0. Altarelli, G. (Univ., Rome); Cabibbo, N; Petronzio, R.; Maiani, L.; Parisi, G. Lett. Nuovo Cim.; 11: No. 14, 609-612 (7 Dec 1974).

The identification of the 3104-MeV vector meson as the W_0 intermediate vector boson which mediates weak neutral current is discussed. Cross section relations for $e^+e^- \to \mu^+\mu^-$ interactions and the branching ratio $h/e = R_{W_e}$ are considered, with good agreement obtained. (JFP)

12658 MONTE CARLO CALCULATION FOR η^0-MESON PHOTOPRODUCTION EXPERIMENT. Vartapetyan, G. A.; Vat'yan, A. L.; Muradyan, E. G.; Sirunyan, A. M.; Khudaverdyan, A. G. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 2, 101-109(1974). (In Russian).

The η^0-meson photoproduction from nuclei in a reaction $\gamma A \to \eta^0 A'$ with the detection of η^0 by two total absorption Cherenkov counters was studied in the incoherent region. The $E_{\gamma max}$ -dependence of η^0-meson yield curve as well as the energy and mass spectra of η^0-mesons with due regard for the resolution of Cherenkov counters were estimated by Monte Carlo technique taking into consideration the Fermi motion of a nucleon in a nucleus. The contribution of background reactions $\gamma p \to \eta^0 N^*$ and $\gamma p \to \eta^0\pi^0 p$ was estimated as well. (auth)

12659 DUALITY CONSTRAINTS ON THE CONSTITUENT–CURRENT QUARK PICTURE FOR THE DECAY OF THE B MESON. Haut, H. (Institut de Physique Théorique, Université de Louvain, Louvain–la–Neuve, Belgium). Phys. Rev. D 10: No. 9, 3097-3100 (1 Nov 1974).

We show how duality constrains the constituent–current quark picture to give, for the $B \to \omega + \pi$ decay, a helicity amplitude ratio in good agreement with experimental data. We also give the predictions for the $35(L = 1) \to 35(L = 0) + \pi$ decays. (auth)

12660 LARGE $\pi\pi$ SCATTERING LENGTHS AND BROKEN CHIRAL SYMMETRIES. Cornwell, D.T.; Genz, H.; Steiner, H. (Institut für theoretische Kernphysik der Universität Karlsruhe,

Karlsruhe, Germany); Eliezer, S. Phys. Rev. D 10: No. 9, 3031-3035 (1 Nov 1974).

In order to allow for a large $\pi\pi$ scattering length $a_0^{(0)}$, a reducible model of chiral-symmetry breaking is considered. Our model yields reasonable possible values for the width of the decay $\eta' \rightarrow \eta\gamma$. A sum rule connecting chiral and dilatational symmetry breaking is furthermore fulfilled in the model. (auth)

12661 RELATIONSHIP BETWEEN THE ISOSPIN-EVEN πN s-WAVE SCATTERING LENGTH AND THE J = 0 $N\bar{N} \rightarrow \pi\pi$ HELICITY AMPLITUDE. Epstein, G.N. (School of Physics, University of Melbourne, Parkville, Victoria, Australia 3052). Phys. Rev. D 10: No. 9, 3068-3069 (1 Nov 1974).

Using dispersion relations we derive a simple relationship between the isospin even πN s-wave scattering length and the $N\bar{N} \rightarrow \pi\pi$ helicity amplitudes f_+^0. We note the use of the result in evaluating the intermediate-range nucleon-nucleon potential. (auth)

12662 PREDICTIONS OF THREE-BODY DECAYS OF MESONS FROM POLE-DOMINATED DISPERSION RELATIONS. Thews, R.L. (Department of Physics, University of Arizona, Tucson, Arizona 85721). Phys. Rev. D 10: No. 9, 2993-3004 (1 Nov 1974).

The meson decays $\eta \rightarrow \pi\pi\gamma$, $\eta' \rightarrow \pi\pi\gamma$, $\eta' \rightarrow \eta\pi\pi$, $\omega \rightarrow 3\pi$, $\phi \rightarrow 3\pi$, and $K^* \rightarrow K\pi\pi$ are studied, using dispersion relations for the related two-body "scattering" amplitudes. Pole dominance of the low-energy part of the dispersion integral with Regge-pole dominance of the high-energy part leads to relations between these three-body decays and various meson two-body decays. When these are known, the approach leads to predictions for the three-body decays in agreement with experiment. In other cases, consistency is shown with the results of vector-meson-dominance couplings, SU(3) -symmetric couplings with η-η' mixing, and upper limits for unobserved decays. (auth)

12663 RADIALLY EXCITED STATES OF MESONS. Chen-Tsai, C.T.; Lee, T.Y. (Institute of Physics, Tsing Hua University, Hsinchu, Taiwan, China). Phys. Rev. D 10: No. 9, 2960-2962 (1 Nov 1974).

A spectroscopic analysis of mesons is carried out within the framework of the harmonic-oscillator quark model, in which the configuration mixing of radially excited harmonic-oscillator states in meson wave functions is considered. The first radially excited state of the π meson is predicted at 1370 MeV, which could be a 5π resonance. The recently observed ρ' (1500) resonance bump is speculated to consist of a radially excited state of the ρ meson at 1530 MeV and an orbitally excited state at 1410 MeV. The long-observed E(1420) and ω' (1675) are identified as the first radially excited states of the η and ϕ mesons, respectively. (auth)

12664 "POWER" VS. "RADIUS" MODELS OF FORM FACTORS: DECAY CHARACTERISTICS. Kamath, S.G.; Sood, S.K.; Mitra, A.N. (Department of Physics, University of Delhi, Delhi-7, India). Phys. Rev. D 10: No. 9, 2869-2875 (1 Nov 1974).

We present a detailed study of the relative performance of two classes of phenomenological form factors, the "power" form factor (PFF) and the "radius" form factor (RFF), in the understanding of pseudoscalar decays of a large number of experimentally known baryon and meson resonances in both (L $\pm$ 1) waves. The PFF which turns out to work best is essentially characterized by the division of each 4-momentum (in the multiple momentum couplings) by the c.m. energy of the daughter baryon and daughter meson for the (L $\pm$ 1) waves, respectively. For the RFF we use two versions, one employed by the Particle Data Group and another proposed by us to incorporate certain features of the Harari radius model. Both sets provide a consistent pattern for (L + 1), wave decays compatible with the universality of reduced coupling constants for Regge and exchange-degenerate partners. For the (L - 1) -wave decays, the PFF has an edge over the RFF because of its flexibility to incorporate the Gell-Mann, Oakes, and Renner effect. It is also pointed out that reaction processes as well as electromagnetic mass differences (considered in separate papers) can discriminate between the two forms, considerably favoring PFF over the RFF. (auth)

Strong (Baryon No. = 1)

12665 (JINR-P2-8133) CONSIDERATION OF INSTABILITY EFFECTS IN REACTIONS OF INCOHERENT PARTICLE PRODUCTION ON NUCLEI. Pak, A. S.; Tarasov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Considering the effects of the instability of ρ^0 and f^0 mesons in the reactions $\pi^{-+}A \rightarrow \rho^0(f^0)A'$ permits one to fit the data with values expected for ρN and fN total cross sections. (1 figure) (auth)

12666 (RL-74-118) DIFFRACTIVE SCATTERING IN THE DUAL MODEL. Hong-Mo, C.; Paton, J. E.; Tsun, T. S. (Science Research Council, Chilton (UK). Rutherford Lab.; Oxford Univ. (UK). Dept. of Theoretical Physics). Aug 1974. 83p. Dep. NTIS (US Sales Only) $7.25.

A method is suggested for calculating the elastic amplitude as the shadow of multiparticle processes. This does not require explicit formulas for the production amplitudes, but depends only on the following assumptions: (a) Regge behavior, (b) semi-local duality, (c) exchange degeneracy. The system is multiperipheral in general structure but because of the assumptions (a) to (c), it incorporates such features as the clustering of final particles and provides a proper treatment of quantum numbers, phases, and resonance spins. As a result, the unitarity sum separates automatically into two components corresponding respectively to Pomeron and ordinary Reggeon exchange, each of which is seen to have the correct qualitative dependence on the quantum numbers, the energy s, and the momentum transfer t. Quantitatively, the elastic amplitude is given in terms of a triple-Regge vertex, for which a simple parametrization is suggested, based on a detailed study of existing experiment and the Veneziano model. The method is then applied to calculate the elastic amplitudes for $\pi \pm p$, $K \pm p$ and pp within the range $6 < s < 50$ and $0 > t > -.5$ GeV^2. Semi-quantitative agreement is obtained with experiment with essentially no free parameter. Although the investigation is restricted at present to elastic scattering as shadow of only the nondiffractive component satisfying (a) to (c), the method is believed to apply also to other diffractive processes, and may be regarded as the first step in an iterative solution of the full unitarity equation. (auth)

12667 DUALITY CONSTRAINTS AND THE BARYON SPECTRUM. Eguchi, T. (Department of Physics, University of Tokyo, Tokyo, Japan). Phys. Rev. D 10: No. 8, 2652-2662 (15 Oct 1974).

It is shown that the exact duality constraints on the baryons, when taken with the baryon spectrum of the harmonic-oscillator quark model, allow SU(6)$_W$-symmetric and crossing-invariant solutions for a wide class of reactions involving the pseudoscalar-meson-baryon scattering. A simple prescription is given for the construction of these solutions. Implications of the solutions on the signs of the resonant amplitudes in SU(3) inelastic processes such as $\pi N \rightarrow \pi\Delta$ are deduced and compared with the higher-symmetry predictions. (auth)

12668 BARYON STRUCTURE IN THE BAG THEORY. Chodos, A.; Jaffe, R.L.; Johnson, K.; Thorn, C.B. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 10: No. 8, 2599-2604 (15 Oct 1974).

A relativistic quark model of the hadron based on the bag theory is presented. The bag equations for massless, Dirac fields with quark quantum numbers are solved in three space dimensions for the special case of a static spherical boundary. These solutions are quantized in an approximation which neglects zero-point fluctuations. The spectrum of low-lying baryon resonances is constructed. The only parameter of the model is fixed by the average mass of the N(938) and Δ (1236). The gyromagnetic ratio, axial-vector charge, and charge radius of the proton are computed and found to be 2.6, 1.09, and 1.0 fm, respectively. Refinements of the quantization procedure are discussed. (auth)

12669 FUNCTIONAL APPROACH TO STRONG-COUPLING THEORY IN STATIC MODELS. I. CHARGED-SCALAR MODEL. Branco, G.C.; Sakita, B.; Senjanovic, P. (Department of Physics, City College of the City University of New York, New York 10031). Phys. Rev. D 10: No. 8, 2573-2582(15 Oct 1974).

The strong-coupling theory in static models is formulated in terms of functional integrations. The method is demonstrated for the charged-scalar model. The expression of elastic and inelastic meson-nucleon scattering amplitudes is obtained to leading order in the strong-coupling expansion (1/g expansion), while the isobar energy levels are obtained up to the next to the leading order. (auth)

12670 TWO-NEUTRON ABSORPTION OF K^- MESONS. Goel, S. P. (Kurukshetra Univ., India); Prakash, Y. Indian J. Pure Appl. Phys.; 12: No. 8, 575-581(Aug 1974).

The absorption of K^- mesons on a pair of neutrons is studied through computer simulation. The results indicate that the criterion used in experimental work to rule out the possibility of occurrence of such a reaction is not adequate for the purpose. (auth)

12671 DESCRIPTION OF LOW ENERGY πN SCATTERING IN A NONLINEAR CHIRAL LAGRANGIAN. Gaisak, M. I.; Lend'el, V. I. (Uzhgorod State Univ., USSR). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 396-397(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 772-775(20 Jun 1974).

A satisfactory description of the energy variation of the πN scattering s and p waves is obtained in the region up to 400 MeV

of kinetic laboratory energy in the single-loop approximation of the nonlinear chiral Lagrangian within the framework of Weinberg's model. (auth)

12672 REMARKS ON RECENT BARYON SPECTROSCOPIC ANALYSES. Lee, T.Y.; Chen–Tsai, C.T. (Institute of Physics, Tsing Hua University, Hsinchu, Taiwan, China). Phys. Rev. D 10: No. 9, 3110-3113 (1 Nov 1974).

A comparison of the results of our previous analysis of the baryon mass spectrum with those of a similar analysis by Horgan and Dalitz is made. The potential parameters chosen for the mass fit in the two analyses are shown to be explicitly related, and their fitted values are found to be compatible where the same input mass data are used. (auth)

12673 NEW ARGUMENT IN FAVOR OF ASYMPTOTIC SU(3): $3/2^+$–DECUPLET MASS SPACING AND DECAYS. Oneda, S.; Takasugi, E. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. D 10: No. 9, 3113-3116 (1 Nov 1974).

We argue that the recent indication from high–statistics experiments that the $3/2^+$ decuplet satisfies equal mass–squared spacing favors a nonperturbative point of view towards broken SU(3), i.e., an algebraic approach based on the hypothesis of asymptotic SU(3) in which, apart from a mixing effect, the Gell–Mann–Okubo mass formula is exact. A further test in the strong decays of hadrons involving pseudoscalar–meson emission is also discussed. We also add a critical remark about the SU(3) formula traditionally used in the SU(3) test of strong decays of hadrons involving pseudoscalar–meson emission. (auth)

12674 ANALYSIS OF BACKWARD πN SCATTERING USING COMPLEX REGGE POLES. Park, R.T. (Department of Physics and Astronomy, California State University, Northridge, Northridge, California 91324). Phys. Rev. D 10: No. 9, 3095-3096 (1 Nov 1974).

The current data on backward πN scattering cross sections and polarization, including CERN–I.P.N. Orsay–Oxford measurements, are analyzed using complex Regge poles. Good fits are obtained with complex N_α, N_γ, and Δ_δ trajectories. There are no MacDowell partners and each trajectory produces the usual baryon spectrum at positive u. (auth)

12675 LOW–ENERGY THEOREM FOR RADIATIVE CORRECTIONS TO PION–NUCLEON SCATTERING LENGTHS. Segrè, G. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104). Phys. Rev. D 10: No. 9, 2934-2942 (1 Nov 1974).

A low–energy theorem is derived which allows us to calculate the radiative corrections to the pion–nucleon scattering lengths in the limit of vanishing pion mass. The effect is appreciable for the even–pion–isospin scattering length. (auth)

12676 ON THE LOW-ENERGY πN SCATTERING AMPLITUDES. Nath, L. M.; Sarker, A. Q. (International Centre for Theoretical Physics, Trieste (Italy)). Phys. Lett., B; 52: No. 2, 213-216(30 Sep 1974).

The pion-nucleon scattering amplitudes with current algebra constraints involving "remainder terms" are calculated by saturating them with the N*(1236) contribution having off-mass shell effects and compared with experiments. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 12703, 12707, 12779, 12784, and 13012.

12677 (JINR-E1-8092) CHARGE EXCHANGE IN THE DEUTERON BREAK-UP AT AN INCIDENT DEUTERON MOMENTUM OF 3.3 GeV/c. Aladashvili, B. S.; Badelek, B.; Glagolev, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The charge exchange deuteron break-up dp → ppn is studied at a 3.33 GeV/c deuteron momentum in the 1 m hydrogen bubble chamber. The contribution of the spin-independent amplitude to the np → pn charge exchange reaction for low t-values was estimated. Various mechanisms playing a role in the considered process are discussed. (auth)

12678 POMERON–POMERON TOTAL CROSS SECTION AND THE REACTION pp → pXp. Buchl, R. A.; Manesis, E. K. (Argonne National Lab., IL). Lett. Nuovo Cim.; 11: No. 14, 631-635 (7 Dec 1974).

The inclusive process pp → pXp is considered to proceed by double pomeron exchange. The pomeron–pomeron annihilation is allowed to form an N-cluster system denoted by X, where N = 1, 2, ... An integral equation is constructed to sum the contributions from all clusters that are diffractively produced by pomeron exchange. The solution of the integral equation predicts a rising PP total cross section. (JFP)

12679 POTENTIAL EFFECTS IN NUCLEON–DEUTERON SCATTERING. Stuivenberg, J. H.; Bruinsma, J.; van Wageningen, R. (Vrije Universiteit, Amsterdam). Czech. J. Phys.; 24: No. 11, 1243-1249(1974).

Nucleon-deuteron breakup cross sections were calculated using different S-wave rank one separable potentials. A proper treatment of the high energy repulsion improves the agreement with experiments. For accurate comparisons the inclusion of exact charge dependence in the calculations is important. A strong correlation between the three-body results and the intrinsic strength of the interaction was found. (auth)

12680 RIGOROUS BOUNDS ON MASSIVE LEPTON PAIR PRODUCTION AND TESTS OF PARTON MODELS. Einhorn, M.B.; Savit, R. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. D 10: No. 9, 2785-2800 (1 Nov 1974).

Using Lagrange inequality multipliers, we derive rigorous upper bounds on cross sections for the process $pN \to l^+l^- + X$, in the context of the parton model. For definiteness, we work with a colored–quark version of the parton model, but our results are easily generalizable to other versions. The constraints we impose are given by our knowledge of νW_2 for protons and neutrons. Then, in a separate problem we add further constraints derived from considerations of the recent neutrino and antineutrino data from Gargamelle. Our upper bounds fall below the Brookhaven data. We conclude, therefore, that at least one of the following statements is true: (1) The experimentally observed cross section is not the scaling limit for the process. (2) The Drell–Yan formula for $pN \to l^+l^- + X$ must be modified. (3) The colored-quark parton model is wrong. (auth)

12681 PROTON–PROTON COLLISIONS IN THE HYDRODYNAMIC THEORY. Chadha, S.; Lam, C.S.; Leung, Y.C. (Department of Physics, McGill University, Montreal, Canada). Phys. Rev. D 10: No. 9, 2817-2827 (1 Nov 1974).

Inspired by some earlier successes of Landau's hydrodynamic theory in explaining the data on high–energy multiparticle production in proton–proton collisions, we investigate exact formulas for the pion inclusive distribution in (1) the hydrodynamic theory, and (2) a statistical variant of this theory in which the thermal motion of the emitted particles is taken into account. All theoretical predictions of the exact spectra are without any free parameters. The results are (1) the exact spectra at Fermi National Accelerator Laboratory (FNAL) and CERN Intersecting Storage Rings energies are substantially broader than those obtained from the formula derived by Landau, (2) at $\sqrt{s} = 52.8$ GeV the exact hydrodynamic theory gives a good description of the experimental data up to a center–of–mass rapidity of approximately 3, and (3) only Landau's original formula for the spectrum gives a satisfactory description of the FNAL data at $s \simeq 565$ GeV^2. We also obtain a formula for the average multiplicity without any adjustable parameter, and find that it gives an excellent description of the data above $s \simeq 100$ GeV^2. (auth)

12682 INDICATIONS OF COMPOSITE STRUCTURE AT MEDIUM ENERGIES. Brayshaw, D.D. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. D 10: No. 9, 2827-2830 (1 Nov 1974).

The assumption of an underlying composite structure for the hadrons is shown to possess interesting implications for N–N and π–π scattering at medium energies. Comparison of the resulting predictions with experiment suggests that such indications are indeed present in the data. (auth)

12683 FINITE–NUCLEAR–SIZE EFFECTS IN K^-d REACTIONS. Chattarji, D.; Talukdar, B.; Sarkar, S.B. (Department of Physics, Visva–Bharati University, Santiniketan, West Bengal, India). Phys. Rev. D 10: No. 9, 2831-2838 (1 Nov 1974).

Pion and proton energy spectra corresponding to direct Λ production and Σ–Λ conversion resulting from capture of K^- mesons on a finite–size deuteron are calculated in effective–range theory with final–state interaction. The results show closer agreement with experiment than earlier work based on the point–nucleus approach. (auth)

12684 DIFFRACTIVE AMPLITUDE OF THE ABSORBED MULTIPERIPHERAL–LIKE MODEL CONSTRAINED BY THE INCLUSIVE TRANSVERSE MOMENTUM DISTRIBUTION. Chiu, C.B.; Gleiser, R.J.; Wang, K. (Center for Particle Theory, University of Texas, Austin, Texas 78712). Phys. Rev. D 10: No. 9, 2853-2868 (1 Nov 1974).

With the constraint of the pion inclusive transverse momentum distribution, we deduce a general expression for the diffractive amplitude of the elastic scattering based on the "absorbed multiperipheral-like (MP-like) model" with the independent-emission (IE) parametrization for transverse momentum cutoffs. For comparison, a diffractive amplitude with the multiperipheral (MP) parametrization is also given. For both cases, the diffractive amplitude, together with an added Regge–pole term, give a reasonable description to pp elastic scattering data for

$p_{lab} \gtrsim 10$ GeV/c and $|t| \lesssim 0.8$ GeV^2, where for p_{lab} beyond 100 GeV/c the contribution of the background term is essentially negligible. It predicts that the total cross section ultimately grows like $\sim (\ln s)^2$. Together with the elastic data, the inclusive transverse momentum data are compatible only with the IE case, but not the MP case. This suggests that within the absorbed MP-like model the transverse momenta of the leading particles are essentially not correlated to those of pions. (auth)

12685 PION-NUCLEON COUPLING CONSTANT. Gersten, A. (Department of Physics, Ben-Gurion University of the Negev, Beer-Sheva, Israel). Phys. Rev. D 10: No. 9, 2876-2880 (1 Nov 1974).

The pion-nucleon coupling constant is determined by comparing the phase shifts obtained by using matrix Padé approximants with the Livermore phase-shift analysis. The calculations are based on one- and two-pion exchanges of the pseudoscalar interaction. Only phase shifts and energy regions which were expected to be dominated by the one- and two-pion exchanges were taken into account. A value of $g^2/4\pi = 13.1 \pm 0.4$ is recommended. (auth)

12686 INCLUSIVE PION SPECTRA AND COMPLEX REGGE POLES. Chen, C.K. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. D 10: No. 9, 2957-2959 (1 Nov 1974).

A quantitative investigation predicts a strong high-energy decrease of $Ed^3\sigma/dp^3$ at $y = 0$, if the large curvature of $Ed^3\sigma/dp^3$ in the pionization region at CERN ISR energies is attributed to complex Regge poles. (auth)

12687 REGGEON-CALCULUS APPROACH TO HIGH-ENERGY SCATTERING ON NUCLEI. Lehman, E.S.; Winbow, G.A. (Daresbury Laboratory, Daresbury, Warrington, Lancashire WA4 4AD, England). Phys. Rev. D 10: No. 9, 2962-2973(1 Nov 1974).

We apply Reggeon calculus to high-energy scattering on nuclei. Using methods similar to those of Abramovskii, Gribov, and Kancheli, we show that intranuclear cascading is forbidden. The inclusive spectrum is shown to be similar to that on hydrogen targets for rapidities $\gtrsim \ln(4Rm)$. We give rough arguments to derive the spectrum for $y \lesssim y_0$ and show that our results are in qualitative agreement with the data. In weak-coupling theory elastic scattering from nuclei is shown to be factorizable and determined by one-Pomeron exchange. We speculate on the absorption length of the Pomeron in nuclear matter in "weak-coupling" and "strong-coupling" theories. Our model is compared with the "energy flux cascade" model of Gottfried and the Landau model. These have local particle production in contrast to multiperipheralism, which involves large longitudinal distances. We predict that the mean inelasticity of the leading particle is independent of A and the spectrum $d\sigma/dy$ is (almost) independent of projectile species. (auth)

12688 DIFFRACTION SLOPE AND INCLUSIVE REACTIONS. Ueda, T. (Osaka Univ. (Japan)). Phys. Lett., B; 52: No. 2, 198-202(30 Sep 1974).

The slope of the inelastic overlap function in the 30 to 1500 GeV p-p scattering is evaluated in a multi-Regge model for inclusive reactions of $pp \to \pi^0 X$ and pX. The slope is found larger than the experimental, particularly at high energies. Cluster production and an increase with energy of the averaged pion multiplicity per cluster are inferred. (auth)

12689 QUARK MODEL PREDICTIONS AND PRODUCTION OF VECTOR RESONANCES AND STRANGE PARTICLES IN THE CENTRAL REGION. Anisovich, V. V.; Kobrinsky, M. N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). Phys. Lett., B; 52: No. 2, 217-219(30 Sep 1974).

The predictions of the quark model are compared with the experimental data on inclusive cross sections of ρ^0, K^{*+} and ω-meson production in pp-collisions at the incident energy 24 GeV, obtained in the recent experiment of Bonn-Hamburg-Munchen Collaboration. It is shown that these data, as well as experimental data on the ratio of Λ-hyperon and K^0_S-meson production at 100 to 300 GeV, are in good agreement with quark model results. (auth)

Particle Invariance Principles and Symmetries

General

12690 STRONG ANOMALIES IN THE PARTIAL CONSERVATION OF THE AXIAL-VECTOR CURRENT AND THE PSEUDOSCALAR-VECTOR-VECTOR VERTEX. Torgerson, R. (Theoretical Physics Institute, Department of Physics, University of Alberta, Edmonton, Alberta, Canada). Phys. Rev. D 10: No. 9, 2951-2954 (1 Nov 1974).

Strong anomalies in the partial conservation of the axial-vector current involving the vector-meson nonet are used in an effective-Lagrangian approach to determine the over-all normalization of the pseudoscalar-vector-vector (PVV) vertex. The result is model-dependent. However, SU(3) symmetry of the VPP vertex leads to nonet symmetry for the PVV vertex and agrees with the experimental data. (auth)

12691 APPLICATIONS OF CHIRAL PERTURBATION THEORY: MASS FORMULAS AND THE DECAY $\eta \to 3\pi$. Langacker, P.; Pagels, H. (The Rockefeller University, New York, New York 10021). Phys. Rev. D 10: No. 9, 2904-2917 (1 Nov 1974).

Several new results on the breaking of chiral SU(3) $\times$ SU(3) are presented within the theoretical framework of chiral perturbation theory. (a) The leading-order corrections to the Gell-Mann-Okubo formula for the baryon octet are shown to be of order $\epsilon^{1/2}$, where ϵ is a chiral symmetry breaking parameter. An explicit exact expression is given for the leading-order corrections which provides a new development in understanding why this formula works so well. Similarly the corrections to the Gell-Mann-Okubo formula for the ground-state pseudoscalar octet are shown to be of order $\epsilon^2 \ln\epsilon$ (including η-η' mixing). On the basis of these exact results it is argued that SU(3) $\times$ SU(3) symmetry is as good as SU(3) symmetry $\sim$30% except when one considers electromagnetic interactions. (b) We examine the $\eta \to 3\pi$ decay on the assumption that it is regulated by a nonelectromagnetic isospin violating term of the type $\epsilon_3 u_3$ with u_3 a member of $\overline{33} \oplus 33$. The strength ϵ_3 of this term is related to the experimental rate including all leading-order chiral-symmetry corrections. This estimate of ϵ_3 leads to $\Delta I = 1$ hadron level shifts about a factor of 2 or 3 too large, although our estimate of ϵ_3 depends sensitively on the experimental details. (c) Octet enhancement, an exact formalism to describe η-η' mixing, and other topics are discussed. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 12594 and 12625.

12692 EFFECTS OF PARITY NONCONSERVATION IN HEAVY IONS. Gorshkov, V. G.; Labzovskii, L. I. (Leningrad Inst. of Nuclear Physics). JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 394-395(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 768-772(20 Jun 1974).

It is shown that for single-quantum transitions in the heavy ions C V and Cu XXVIII the degree of photon circular polarization produced in the presence of weak interactions reaches 10^{-3} in Weinberg's model. (auth)

12693 APPLICATION OF CURRENT ALGEBRA TECHNIQUES TO NEUTRAL-CURRENT-INDUCED THRESHOLD PION PRODUCTION. Adler, S.L. (National Accelerator Laboratory, Batavia, Illinois 60510). Phys. Rev. Lett. 33: No. 25, 1511-1513 (16 Dec 1974).

I apply current-algebra techniques to study threshold pion production induced by the weak neutral current. In addition to specific predictions for the Weinberg-Salam-model current, I find upper bounds on the magnitude of threshold pion production for an isoscalar neutral current and for a general hadronic neutral current formed from the usual vector and axial-vector nonets. Violation of these bounds would suggest the presence of new coupling types in the neutral semileptonic interaction. (auth)

Applications (Strong)

Refer also to abstracts 12660, 12667, 12673, and 12778.

12694 ASYMPTOTIC FREEDOM AND GOLDSTONE REALIZATION OF CHIRAL SYMMETRY. Lane, K. (Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. D 10: No. 8, 2605-2618 (15 Oct 1974).

The feasibility of Goldstone realization of weakly probed chiral symmetries is examined in the case that strong interactions are described by an asymptotically free theory of zero-bare-mass quarks and gauge vector gluons. This investigation is restricted to finding solutions to the homogeneous Bethe-Salpeter equation for the symmetry-breaking part G of the quark propagator S, $G(p)\,\gamma_5 \propto [S^{-1}(p), \gamma_5]$, in the limit $p^2 \to -\infty$. Renormalization group techniques are extremely useful in this limit, and are used extensively. Their naive application implies the leading asymptotic behavior $G(p) \sim (\ln p)^{-A}$, where A is a calculable positive constant. More importantly, it is shown that the Bethe-Salpeter kernel is well approximated by the ladder graph alone, with the effective coupling $g^2(p) \sim (\ln p)^{-1}$, when the strong interactions are asymptotically free. Two solutions are found for G. The asymptotically dominant one, $G_+(p) \sim (\ln p)^{-A}$, is just what was

predicted by straightforward renormalization–group analysis, and does not correspond to Goldstone realization of the symmetry. The other solution has much softer asymptotic behavior, $G_-(p) \sim p^{-2}(\ln p)^{\Lambda}$. That this solution actually corresponds to the Goldstone mode is established by relating it, through the axial–vector Ward identity, to the Goldstone–boson–quark–antiquark vertex function, whose large–momentum limit is analyzed via the Wilson operator–product expansion. (auth)

12695 DEPENDENCE OF THE NONRENORMALIZATION THEOREM IN THE CHIRAL–SYMMETRY LIMIT ON THE DIRECTION OF APPROACH. Baće, M. (Max–Planck–Institut für Physik und Astrophysik, München, Germany); Cornwell, D.T. Phys. Rev. D 10: No. 8, 2694-2696 (15 Oct 1974).

The leading (in $SU_3 \otimes SU_3$) contribution to the deviation from their symmetric values of the $\Delta S = 1$ vector form factors, recently calculated by Langacker and Pagels, is expressed as $\epsilon_8{}^2 F(\epsilon_0, \epsilon_8)$. Here ϵ_0 and ϵ_8 are the familiar symmetry–breaking parameters. In their work the SU_3 dependence of $F(\epsilon_0, \epsilon_8)$ is ignored and $F(\epsilon_0, 0)$ is used. We show this extrapolation to be unnecessary since identical techniques yield $F(\epsilon_0, \epsilon_8)$. We find $G(\epsilon_0, \epsilon_8) \simeq 1.5\ F(\epsilon_0, 0)$. (auth)

12696 COMMENTS ON ALTERNATE FORMS FOR THE BREAKING OF CHIRAL SU(3) ⊗ SU(3). Deshpande, N.G.; Dicus, D.A. (Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712). Phys. Rev. D 10: No. 9, 3048-3055 (1 Nov 1974).

Possible alternatives to the usual $(3^*, 3) \oplus (3, 3^*)$ form for the symmetry breaking of chiral SU(3) ⊗ SU(3) are discussed. The width for the decay $X \to \mu\pi\pi$ is calculated in the pure $(6^*, 6) \oplus (6, 6^*)$ breaking model, and the result is compared with $(3^*, 3) \oplus (3, 3^*)$ and (8, 8) models. The symmetry–breaking parameters are shown to be restricted to certain allowed regions for both $(6^*, 6) \oplus (6, 6^*)$ and (8, 8) representations on the basis of positivity of spectral functions. These restrictions are shown to be particularly severe if the additional assumption $f_K \geq f_\pi$ is imposed. Based on $X \to \mu\pi\pi$ and present $\pi\pi$ scattering data we conclude that a symmetry breaking which is reducible into $(3^*, 3) \oplus (3, 3^*)$ and (8, 8) is favored and we estimate the relative amounts of the two types of breaking. (auth)

Scattering Theory

Refer also to abstracts 12547, 12652, 13010, and 13011.

12697 DEDUCTION OF ASYMPTOTIC STEINMANN RELATIONS FROM THE REGGE HYPOTHESIS. Finkler, P.; Jones, C.E.; Misheloff, M.N. (Behlen Laboratory of Physics, University of Nebraska, Lincoln, Nebraska 68508). Phys. Rev. D 10: No. 8, 2647-2651 (15 Oct 1974).

The analytic structure of the double–Regge vertex, which has previously been obtained from the Steinmann relation, is derived by using a natural generalization of the Regge hypothesis. (auth)

12698 HIGH ENERGY BEHAVIOR IN INFINITE CHANNEL POTENTIAL SCATTERING. Capri, A. Z.; Kreuzer, H. J. (Univ. of Alberta, Edmonton). Can. J. Phys.; 52: No. 20, 2002-2006 (15 Oct 1974).

It is shown that for an infinite channel potential scattering problem with bordered interaction, the resultant generalized optical potential is always a bounded function of the energy if it exists as an operator. Thus for this type of model no infinitely rising Regge trajectories are possible. (auth)

12699 ANALYTICAL PROPERTIES OF THE SCATTERING AMPLITUDE IN THE STRONG COUPLING THEORY. Semenov, S. V.; Timofeevskaya, O. D.; Tyurin, N. E. (Inst. of High Energy Physics, Serpukhov, USSR). Teor. Mat. Fiz.; 21: No. 2, 207-212(Nov 1974). (In Russian).

A system including two nonrelativistic particles and quantized scalar field is considered. If the coupling between the field and the particles is strong, the interaction potential between the particles is smooth and coincides with the Yukawa potential at $r \to \infty$. Analytical properties of the scattering amplitude are studied, and an estimate of the amplitude in the region, where the momentum transfer is small as compared with the energy, is performed. (auth)

12700 STRONG ASYMPTOTIC COMPLETENESS OF WAVE OPERATORS FOR HIGHLY SINGULAR POTENTIALS. Amrein, W. O.; Georgescu, V. (Univ., Geneva). Helv. Phys. Acta; 47: No. 4, 517-533(1974).

The existence and strong asymptotic completeness of the wave operators for rotation invariant Schroedinger Hamiltonians with highly singular (repulsive or attractive) potentials is proven. (auth)

12701 LOW ENERGY STRUCTURE OF THE FEYNMAN S-MATRIX. Gerdzhikov, V. S.; Kulish, P. P. (Mathematical Inst., Leningrad). Teor. Mat. Fiz.; 21: No. 2, 183-194(Nov 1974). (In Russian).

For the renormalized S-matrix in quantum electrodynamics the formula is established, which singles out the infrared divergency in an explicit form. A description of the low energy asymptotics of the S-matrix coefficient functions is given. (auth)

12702 NEW SEPARABLE EXPANSION FOR LOCAL POTENTIALS. Adhikari, S.K. (School of Mathematics, The University of New South Wales, Kensington, New South Wales, Australia 2033). Phys. Rev. C 10: No. 5, 1623-1628 (Nov 1974).

A simple and practical method is given for constructing a rapidly convergent separable expansion, with simple form factors, for the t matrix of a local potential. The requirement of two–particle unitarity is maintained for approximations of any rank. Unlike commonly used methods, the calculation of eigenfunctions and eigenvalues of the kernel of the Lippmann–Schwinger equation is not required. The method is illustrated for the two of the commonly used nucleon–nucleon potentials and the results compared with the unitary pole expansion and the exact results. Also in these cases our method yields an excellent rank-one approximation to the t matrix. (auth)

12703 ENERGY–DEPENDENT SEPARABLE POTENTIALS. Ernst, D.J. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106); Londergan, J.T.; Moniz, E.J.; Thaler, R.M. Phys. Rev. C 10: No. 5, 1708-1721 (Nov 1974).

A method for constructing energy–dependent separable potentials of the form $V = \lambda(E)\ |v\rangle\langle v|$ from (complex) elastic scattering phase shifts is presented. The energy–dependent coupling constant $\lambda(E)$ is shown to satisfy a dispersion relation as a consequence of the requirement of multichannel unitarity. It is this knowledge of the analytic properties of $\lambda(E)$ which makes it possible to solve the inverse problem. It is further demonstrated that in some cases the inverse problem can still be solved analytically even when the phase shift changes sign below the inelastic threshold. (auth)

12704 K MATRIX AND UNITARITY CONSTRAINTS ON OFF–SHELL T MATRIX ELEMENTS. Kouri, D.J. (Max–Planck–Institut für Strömungsforschung, 3400 Göttingen, Böttingerstrasse 6/8, Federal Republic of Germany); Levin, F.S. Phys. Rev. C 10: No. 5, 2096-2098 (Nov 1974).

A discussion of off–shell properties of the T matrix is given based on the damping equation and unitarity. The off–shell function $\varphi_l(k,q)$ of Baranger et al. is shown to be $\varphi_l(k,q) = \cos\delta_l(k)\ \langle k|K_l(k^2)|q\rangle$, where δ_l and K_l are the phase shift and partial–wave K (reaction) operator. The ratio of the imaginary to the real part of the half–off–shell partial–wave T matrix element is shown to be $\tan\delta_l(k)$, thus providing a unitarity constraint to be satisfied by any approximate T matrix elements. In addition, the imaginary part of the fully–off–shell T matrix element is shown to be proportional to the product $\varphi_l(p,k)\ \varphi_l(k,q)$. These results hold for both one–body and two–channel identical particle scattering. (auth)

12705 UNITARITY AND ANALYTICITY BOUNDS ON INCLUSIVE CROSS SECTIONS. Scanio, J.J.G.; Suranyi, P. (Department of Physics, University of Cincinnati, Cincinnati, Ohio 45221). Phys. Rev. D 10: No. 9, 2954-2957 (1 Nov 1974).

Upper bounds on inclusive cross sections are derived using unitarity and general analyticity assumptions. The bounds do not contain unknown constants and can be tested experimentally. The bounds are saturated to within logarithmic factors of the energy if the inclusive cross sections scale at high energy. (auth)

12706 FACTORIZATION AS AN APPROXIMATE PROPERTY OF THE SCATTERING OF COMPOSITE SYSTEMS. Fishbane, P.M.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 10: No. 9, 3005-3016 (1 Nov 1974).

It is shown that total cross sections for the scattering of two composite systems will factorize to an extremely good approximation provided that the two systems do not differ markedly from each other either in number of constituents or size. Two separate cases are examined in detail: the optical case, in which the constituents are much smaller than the system, and the overlap case, in which the constituents are larger than the radius in which the constituent centers are confined. The smooth transition between these two regions is examined when the numbers of constituents are two and three. (auth)

12707 SCATTERING FROM COMPOSITE SYSTEMS IN THE FROISSART LIMIT. Camillo, P.; Fishbane, P.M.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 10: No. 9, 3022-3030 (1 Nov 1974).

The nature of scattering from composite systems in the case where the constituent cross sections saturate the Froissart bound is discussed. The questions of whether or not all cross sections approach the same

limit, and whether the ratio of the elastic to total cross section approaches 1/2 are discussed. The answers to these questions depend crucially on the form of the profile functions of the constituents. (auth)

12708 SEARCH PROGRAM FOR SIGNIFICANT VARIABLES. O'Connell, M. J. (Science Research Council, Chilton (UK). Rutherford Lab.). Comput. Phys. Commun.; 8: No. 1, 49-55(Aug 1974).

The coordinates associated with readings of one or more independent variables are converted into significant linear combinations of the original independent variables. Eigenvalues and eigenvectors of the "dispersion" matrix for the problem are calculated, and the "position vector" of each observation is analyzed into the components along the normalized eigenvectors. If the eigenvalues are arranged in decreasing order or the linear combination in corresponding order, the most important linear combination is the first and the least important is the last. If some eigenvalues are very small relative to the largest, then the corresponding linear combination may be ignored or set to zero. In this way the complexity of a problem can be reduced. The derivation of momenta from spark chamber coordinates using this method has been discussed by Wind, from whose original program the present version was standardized. (auth)

12709 SEMICLASSICAL APPROXIMATION WITH COMPLEX TRAJECTORIES. Knoll, J.; Schaeffer, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Theorique). Phys. Lett., B; 52: No. 2, 131-134(30 Sep 1974).

The semiclassical description of elastic scattering is extended to include complex trajectories. Initial results are presented. A unified description of rainbow, diffraction, and interference phenomena is achieved, leading to a quantitiative agreement with quantum mechanical calculations. (auth)

12710 SOME t-CHANNEL ASPECTS OF A GEOMETRICAL POMERON. Buras, A. J. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett., B; 52: No. 2, 210-212(30 Sep 1974).

The geometrical scaling is discussed in the case of total cross sections behaving at high energies like $(\ln s)^{\eta}$, and it is shown that the case $-1 \leq \eta \leq 0$ is inconsistent with t-channel unitarity; the structure of the t-channel partial wave amplitudes is $A(t,j) \propto 1/(-t)^{1+r}\, H(\kappa \equiv (j-1)/(-t)^{r})$ with $r = \eta^{-1}$ and the t-dependence of the j-plane singularities is given for $\eta > 0$ by $\alpha(t) = 1 + a\,(-t)^{1/\eta}$ with a being constant. (auth)

12711 LARGE N EXPANSION IN DUAL MODELS. Veneziano, G. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 52: No. 2, 220-222(30 Sep 1974).

A "topological" expansion, recently proposed for unitarization of planar dual models, is reformulated as a 1/N expansion. The possible connection of this expansion to those used for multiparticle production at high energy is pointed out. (auth)

PHYSICS (LOW-TEMPERATURE)

12712 LOW TEMPERATURE PHYSICS: LT 13. Volume 2. Quantum Crystals and Magnetism. 13th International Conference Held at Boulder, Colorado, August 21–25, 1972. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corporation (1974). 678p. (CONF-720833-(P2)). $35.00.

The 112 papers are arranged into sections dealing with (1) quantum crystals: He lattice dynamics; ^{3}He nuclear magnetism; He monolayers; molecular solids (H_2, D_2, HD); other topics; (2) magnetism: phase transitions; low-dimensional systems; ferromagnetism; dilute alloys; theory; magnetism and superconductivity; and small particles, heat capacity, and paramagnetism. Separate abstracts have been prepared for 32 of the papers. (Indexes are included.) (DLC)

For abstracts of individual papers see: 11861–11863, 12047–12067, 12129–12135, and 12745.

Superfluidity

12713 (AD-783381) CRITICAL PHENOMENA AND LIQUID HELIUM. Final Report, 15 August 1971–31 December 1973. Rice, O. K. (North Carolina Univ., Chapel Hill (USA)). 31 Jul 1974. Contract ARO(D)-31-24-G669. 9p. (AROD-3019.29-C). NTIS $4.00.

Research is summarized on the following topics: energy fluctuations and rotons in liquid helium; Landau's theory of liquid helium; the motion of a sphere in a perfect fluid; the fundamental laws of thermodynamics and statistical mechanics; interatomic forces in and thermodynamic properties of solid argon; melting phenomena in simple solids; thermodynamics and statistical mechanics of critical lines and critical points, with applications to 3He–4He mixtures, binary liquid systems, and pure substances; experimental work on coexistence curves in binary liquid systems, and experimental and theoretical work on the effect of impurities; experimental equipment for temperature control. A bibliography and list of coworkers are included. (GRA)

12714 (HU-TFT–74-14) EFFECT OF FERMI LIQUID CORRECTIONS ON THE STATIC SUSCEPTIBILITY OF THE BALIAN–WERTHAMER STATE IN ^{3}He. Vuorio, M. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

The effects of Fermi liquid corrections on the static susceptibility of the Balian–Werthamer superfluid state are calculated. Even though the susceptibility is isotropic in position space, the spin polarization in k-space is anisotropic, since the magnetically effective density of states behaves as $\sin^2\theta$. All Landau parameters F_L^a with even L are coupled, if $F_2^a \neq 0$. A large positive value of F_2^a is needed to explain the experimental observations. (auth)

12715 SOLUTION OF TWO ALMOST PERFECT BOSE GASES. Mineev, V. P. (Inst. of Solid State Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 263–272(Jul 1974). (In Russian).

A solution of two almost ideal Bose gases at a temperature close to absolute zero is considered. It is found that two independent superfluid motions of the components with different velocities may exist in such solutions. It is shown that there are two Goldstone elementary excitation branches with a linear dispersion law for small momenta. It is found that sound velocities corresponding to the two branches are, in the limit of small concentrations, identical to the velocities of first and second sounds in the hydrodynamics of solutions of two superfluid liquids. The problem of the dependence of energy of the elementary excitations on velocities in the presence of two independent motions in the solution is also considered and the Landau superfluidity criterion for such solutions is found. (auth)

12716 COMMENT ON "SUPERFLUID FLOW IN RESTRICTED GEOMETRIES". Padmore, T.C.; Reppy, J.D. (Laboratory of Atomic and Solid State Physics and Materials Science Center, Cornell University, Ithaca, New York 14850). Phys. Rev. Lett. 33: No. 23, 1410-1412 (2 Dec 1974).

It is argued that experiments on superflow in pores, films, and channels can be interpreted without the introduction of a superfluid healing length. (auth)

12717 MOMENT CALCULATION OF VACANCY-INDUCED SPIN DIFFUSION IN bcc SOLID ^{3}He. Landesman, A. (Service de Physique du Solide, Gif-sur-Yvette, France). J. Low Temp. Phys.; 17: No. 3-4, 365-374(Nov 1974).

The self-diffusion constant in bcc solid ^{3}He is calculated in the temperature regime where an atom changes place with a neighboring vacancy more often than flip-flops are induced through the Pauli exchange interaction. The calculation is based on the method of moments and describes vacancies with a model of fictitious spin S = 1. The scattering of phonons by vacancies impedes the quantum tunneling of vacancies: the quantitative discussion of this effect shows that its relation with the lifetime of vacancy waves is not simple. (auth)

12718 NEUTRON–SCATTERING STUDY OF COLLECTIVE EXCITATIONS IN SUPERFLUID HELIUM. Graf, E.H. (State University of New York, Stony Brook, New York 11790); Minkiewicz, V.J.; Bjerrum Møller, H.; Passell, L. Phys. Rev. A 10: No. 5, 1748-1761 (Nov 1974).

Extensive inelastic–neutron–scattering experiments have been performed on superfluid helium over a wide range of energy and momentum transfers. A high–resolution study has been made of the pressure dependence of the single–excitation scattering at the first maximum of the dispersion curve over the range 1–24.4 atm and at 1 atm of the wave–vector dependence of the single–excitation scattering beyond the roton minimum. The latter data, but not the former, are consistent with the idea of an instability threshold suggested by Pitaevskii and by Enz. The pressure and wave–vector dependence of the multiexcitation scattering was also studied. It is shown that the multiphonon spectrum of a simple Debye solid with the phonon dispersion and single–excitation cross section of superfluid helium qualitatively reproduces these data. (auth)

12719 SECOND–SOUND VELOCITY, SUPERFLUID DENSITY, AND UNIVERSALITY NEAR THE SUPERFLUID TRANSITION IN ^{3}He–^{4}He MIXTURES. Ahlers, G. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. A 10: No. 5, 1670-1684 (Nov 1974).

A detailed analysis is presented for second–sound velocity (u_2) measurements in ^{3}He–^{4}He mixtures near T_λ in terms of thermodynamic parameters and the superfluid fraction ρ_s/ρ. Several incorrect conclusions in the literature are corrected. The hydrodynamic expressions for the velocities of the propagating modes are obtained for the case where the thermal expansion coefficient does not vanish. The relevant thermodynamics near the λ line is discussed, and expressions for the necessary parameters in terms of measured quantities are given. The importance of various contributions to u_2 is considered. The experimental data for u_2 are reviewed, and the corresponding results for the superfluid fraction are calculated. Special attention is given throughout to the propagation of errors from the uncertainty in thermodynamic parameters. The results for ρ_s/ρ are found to be consistent with those obtained by the oscillating–disk method, as expected from two–fluid hydrodynamics. The difference in behavior of ρ_s along paths of constant concentration and constant chemical potential is considered. The exponent of ρ_s is found to be consistent with scaling and universality. The superfluid density is compared with the measured superfluid healing length l, and the parameter $l\rho_s/T$ is found to be independent of the concentration X. The data for ρ_s are also found to be consistent with a concentration–independent free energy per correlation volume, as expected on the basis of universality arguments. (auth)

12720 SPIN WAVES IN SUPERFLUID ^{3}He: COLLISIONLESS REGIME. Combescot, R. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14850). Phys. Rev. A 10: No. 5, 1700-1710 (Nov 1974).

Spin waves in superfluid ^{3}He are studied in the collisionless regime by introducing a canonical transformation in the kinetic equation for the distribution–function matrix. This transformation is a space–time–dependent spin rotation, which takes into account the fluctuations of the direction of the order parameter which are coupled to the spin–density fluctuations. After the transformation, the order parameter is invariant. The kinetic equation is then expanded to lowest order in ω and $\vec{q}$ and diagonalized. Fermi–liquid effects are taken into account. The result is a set of equations describing the coupled motion of the superfluid parameters and the quasiparticle distribution. In the axial state, only two degenerate spin–wave modes exist. These have their spin polarization perpendicular to the direction of the order parameter in spin space. In the isotropic state, one longitudinal and two transverse modes are obtained. Equations giving the velocity of these modes are written. (auth)

12721 INTERPRETATION OF SPECIFIC–HEAT MEASUREMENTS IN SUPERFLUID ^{4}He. Gould, H. (Department of Physics, Clark University, Worcester, Massachusetts 01610); Wong, V.K. Phys. Rev. A 10: No. 5, 1896-1897 (Nov 1974).

It is pointed out that the cubic term in the phonon spectrum of superfluid ^{4}He cannot be rigorously determined from specific–heat measurements. (auth)

12722 IMPLICATIONS OF THE ^{3}He PHASE DIAGRAM BELOW 3 mK. Leggett, A. J. (Tokyo Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1275-1277(Apr 1974).

12723 THERMODYNAMICAL CALCULATION OF THE FORCES ACTING ON VORTICES IN SUPERFLUID HELIUM. Lhuillier, D.; Francois, M. (Univ., Paris). Delft Progr. Rep., Ser. B; 278: No. 16, 727-730(17 Apr 1974). (In French).

A new interpretation for Landau equations is used to propose a simple explanation for the various forces acting on vortices in the absence of energy dissipation. Landau equations are generalized to take account for possible vortices. It is shown that difficulties remain in proving certain expressions currently admitted for the mutual friction force. (FR)

12724 ENTROPY OF SUPERFLUID ^{4}He AT SATURATED VAPOR PRESSURE. Sudraud, M.; Varoquaux, E. (Paris Univ., Orsay, France). Delft Progr. Rep., Ser. B; 278: No. 21, 921-923(20 May 1974). (In French).

^{4}He entropy was measured using a differential manometer operating at low temperature. Values obtained for the saturated vapor pressure, between 1 and 2K are 1% greater than previous values on an average. (FR)

12725 HYDRODYNAMICS OF AN ANISOTROPIC SUPERFLUID: VISCOSITY TENSOR. Seiden, J. (Paris Univ., Orsay, France). Delft Progr. Rep., Ser. B; 278: No. 23, 1009-1012 (5 Jun 1974). (In French).

The hydrodynamics of an Anderson-Morel type anisotropic superfluid is developed. The study is based upon the transport equation of the constituent quasi-particles. The flux tensor of the momentum density is determined in the case of a cylindrical symmetry. (FR)

12726 PROBABLE OBSERVATION OF THE TWO-ORIFICE MACROSCOPIC INTERFERENCE EFFECT IN SUPERFLUID HELIUM. Gamota, G. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 33: No. 24, 1428-1431 (9 Dec 1974).

I have observed level differences between two baths of superfluid helium which are multiply connected by two orifices whenever the flow velocity past the orifices was of such value as to cause the quantum-mechanical phase difference between them to be an odd multiple of π. (auth)

12727 BREAKING THE ROTON BARRIER: AN EXPERIMENTAL STUDY OF MOTION FASTER THAN THE LANDAU CRITICAL VELOCITY FOR ROTON CREATION IN He II. Phillips, A.; McClintock, P.V.E. (Department of Physics, University of Lancaster, Lancaster, England). Phys. Rev. Lett. 33: No. 25, 1468-1471 (16 Dec 1974).

We report the first observation of objects moving through He II with equilibrium drift velocities $\bar{v}$ beyond the Landau critical velocity v_c for roton creation. With T~0.4 K, P=25 bar, F=2 kV cm^{-1}, $\bar{v}-v_c$ for negative ions is larger than a theoretical prediction by a factor of $\sim 10^3$. The vortex-ring nucleation rate is found to decrease with F above 300 V cm^{-1}, thus resolving apparent inconsistencies between earlier experiments. (auth)

Superconductivity

Refer also to abstracts 11746, 11749, 11827, 11899, 11900, 11904, 11905, 11908, 11952, 11981, 11983, 11984, 11989, 11993-11995, 12046, 12060-12066, 12068, 12072, 12073, and 12076.

12728 EFFECT OF CONDENSATE MOTION ON THE THERMOELECTRIC PROPERTIES IN SUPERCONDUCTORS. Aronov, A. G. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 67: No. 1, 178-185(Jul 1974). (In Russian).

It is shown that in the presence of a continuous current in a thin ring consisting of two superconductors, the thermoelectric current appreciably depends on the magnitude of the undamped current. The change in the thermoelectric current in this case is proportional to the phonon relaxation time whereas the ordinary thermoelectric current is determined by the total relaxation time. (auth)

12729 PARAMAGNETIC EFFECT OF THE TWO-DIMENSIONAL MIXED STATE IN SUPERCONDUCTORS OF THE FIRST KIND. Landau, I. L. (Inst. of Problems in Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 250-262(Jul 1974). (In Russian).

A new type of paramagnetic effect in hollow cylindrical indium single crystals is detected experimentally and investigated. It is found that on destruction of superconductivity in such samples by a current in the presence of a longitudinal magnetic field the magnitude of the longitudinal magnetic field in the sample aperture appreciably exceeds the external field even when the current strength in the sample exceeds I_1; in the latter case practically the whole volume of the sample is in the normal state and all differences between the sample properties and those of the normal metal are due to a thin layer of the two-dimensional mixed state on its inner surface. (auth)

12730 POSSIBLE PHASE TRANSITIONS IN SYSTEMS OF INTERACTING METALLIC THREADS (QUASI-ONE-DIMENSIONAL METALS). Gor'kov, L. P.; Dzyaloshinskii, I. E. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 397-417(Jul 1974). (In Russian).

The effect of interaction between threads on the properties of quasi-one-dimensional metals is considered. It is shown that along with the state considered previously in which dielectric and superconducting pairing coexist on a single thread, either purely dielectric state or the Peierls type of a state of the mixed type may be possible as a result of the interaction. For these states the superconducting and dielectric gaps Δ^{ik} are essential functions of the threads numbers i, k. The effect of transverse motion on the transition temperature and the possibility of superconducting states are taken into account. (auth)

12731 ELECTRON SCATTERING BY A VORTEX LATTICE IN A SUPERCONDUCTOR MIXED STATE. Krylov, I. P. (Inst. of Problems in Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 376-390(Jul 1974). (In Russian).

The effect of an ideal vortex lattice on the motion of normal electrons is considered near the critical field for transition to the mixed state, H_{c_2}. It is shown that the presence of vortices leads to scattering of electrons such that the quasiparticle excitation of the electron branch changes into hole excitation and vice versa. Stationary normal electron states in a magnetic field are described in the Landau representation. The matrix elements of the pairing potential between stationary electron states are determined by perturbation theory methods and the probability for an electron-hole transition W in the mixed state near H_{c_2} is calculated. The value of W obtained is employed for calculating the variation in thermal conductivity and thermal Hall angle at transition from the normal to mixed state. The results of the calculations are in agreement with experimental data for pure niobium. (auth)

12732 EFFECT OF SCATTERING PROCESSES ON THE ANOMALIES IN THE THERMODYNAMIC CHARACTERISTICS OF SUPERCONDUCTORS UNDER PRESSURE. Makarov, V. I.; Bar'yakhtar, V. G.; Gunn, V. V. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 67: No. 1, 168-177(Jul 1974). (In Russian).

It is shown that anomalies in T_k and $\partial T_k/\partial P$ due to variation of the Fermi surface can be expressed in terms of the solution of the Eliashberg equations for an anisotropic superconductor in which variation in topology of the Fermi surface is not taken into account. The analysis is based on the Eliashberg equations in which anisotropy of electron-phonon interaction is taken into account. In a first approximation in the small parameter $\delta\nu/\nu$ ($\delta\nu$ is an addition to the density of states ν due to variation of the Fermi surface topology) an analytic expression is obtained for ΔT_k and $\partial T_k/\partial P$ for both pure superconductors and impurity superconductors. It is shown that the effect of impurities on ΔT_k is due to two competing mechanisms: to decrease of the lifetime and to isotropization of the quasiparticle energy gap. Depending on the nature of the gap anisotropy in the superconductor, the T_k and $\partial T_k/\partial P$ anomalies due to variation of the Fermi surface topology induced by impurities may either smooth out or the effect of electron scattering by impurities may be weaker. (auth)

12733 FLUCTUATION-INDUCED CONDUCTIVITY ABOVE THE CRITICAL TEMPERATURE IN SMALL-PARTICLE ARRAYS. Kirtley, J.; Imry, Y.; Hansma, P. K. (Univ. of California, Santa Barbara). J. Low Temp. Phys.; 17: No. 3-4, 247-254(Nov 1974).

Small tin particle arrays show a component of conductivity above the critical temperature that can be described by an Aslamasov-Larkin-type fluctuation-induced conductivity term $\Delta\sigma_0$ in the zero-dimensional limit. A simple model is introduced to unfold experimental results for $\Delta\sigma_0$ from experimental data. Those results show that it is proportional to $1/(T - T_c)^2$ over a broad temperature range, in agreement with theoretical predictions. Its absolute magnitude is difficult to measure precisely, but our estimate for it is of the same order of magnitude as the theoretical prediction. Other order-of-magnitude estimates show that Josephson coupling, thermal noise, and Maki term effects can be neglected for $T - T_c > 20$ mK. (auth)

12734 FLUX FLOW IN TYPE II SUPERCONDUCTING WIRES IN LONGITUDINAL MAGNETIC FIELDS. Nicholson, J. E.;

Sikora, P. T. (Univ. of Oklahoma, Norman). J. Low Temp. Phys.; 17: No. 3-4, 275-286(Nov 1974).

The resistive behavior of a type-II superconducting wire in the presence of a longitudinal applied magnetic field is studied. The experimental data obtained are compared with the predictions of a phenomenological model based on viscous flux flow. For appropriate surface conditions the model is in satisfactory qualitative agreement with observations. The problems involved in obtaining a numerical value for the flux flow resistivity from longitudinal field I–V data are discussed. Estimates of the flux flow resistivity are made and are shown to be in order-of-magnitude agreement with accepted values. (auth)

12735 SUPERCONDUCTING PHASE TRANSITIONS IN GRANULAR SYSTEMS. Deutscher, G. (Department of Physics and Astronomy, Tel–Aviv University, Ramat Aviv, Israel); Imry, Y.; Gunther, L. Phys. Rev. B 10: No. 11, 4598-4606 (1 Dec 1974).

We consider a model for granular superconductors consisting of an array of small superconducting particles interacting by Josephson coupling through insulating barriers. We obtain systematically the various critical regions, critical temperature shifts, and crossover regions between zero– and three–dimensional behavior as functions of measurable sample parameters. The qualitative behavior of the system in the various regimes is analyzed and results for the specific heat and fluctuation conductivity in the Gaussian region above T_c are obtained. The possibility of obtaining large critical regions is emphasized. The conditions for observing the phase–locking transition distinct from quasiordering within the grains are found. Theoretical predictions are compared with existing experimental results. (auth)

12736 CURRENT–INDUCED RESISTIVE STATE IN CYLINDRICAL TYPE–I SUPERCONDUCTORS. Watson, H.L.; Huebener, R.P. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 10: No. 11, 4577-4583 (1 Dec 1974).

We have investigated the current–induced resistive state in superconducting indium wires through simultaneous measurements of the dc resistive voltage and the electrical noise power as the electrical transport current was increased from zero to beyond the critical value. The experiments were performed in zero applied magnetic field using indium wires with diameters of 0.17–0.52 mm. The measurements were made below the λ point to discriminate against contributions from thermal fluctuations in the specimens due to nucleate boiling of liquid helium. The noise power was measured in the frequency range 20 Hz–20 kHz. For two specimens with diameters of 0.17 mm, a peak in the noise power was observed at the critical value of the transport current. The noise–power spectrum of one of the smallest–diameter samples showed very weak dependence of noise power on frequency at low frequencies and approximately ω^{-2} behavior at high frequencies. The magnitude of the noise voltage at the noise–power peak was found to be at most 2.4×10^{-3}% of the dc resistive voltage. No ac voltages larger than 10^{-5}% of the dc voltage were detectable for samples with diameters of 0.27 and 0.52 mm. Our results cast doubt on the validity of the Gorter dynamic model of the current–induced intermediate state and tend to support a static model of the type first proposed by London. (auth)

12737 SELF–RESONANT MODES IN HIGH–Q JOSEPHSON TUNNEL JUNCTIONS. Gou, Y.S.; Gayley, R.I. (Department of Physics and Astronomy, State University of New York at Buffalo, Buffalo, New York 14214). Phys. Rev. B 10: No. 11, 4584-4592 (1 Dec 1974).

Our tin–tin oxide–tin tunnel junctions, when excited in their resonant electromagnetic cavity modes, exhibit quality factors Q as high as 660. This has allowed us to test Kulik's extension of Fiske–mode theory. We have verified his prediction that the dc current associated with a Fiske mode goes through a peak as Q increases, and we find his numerical value for the height of this peak to be correct. We find a small disagreement with his prediction of the value of the magnetic field that will maximize the dc current. We have also made some measurements of zero–field modes and of small, anomalous modes occuring at half–integral mode positions. (auth)

12738 ENERGY SPECTRUM OF THE EXCITATIONS IN A SPHERICAL SUPERCONDUCTING INCLUSION. Gvozdikov, V.M.; Fal'ko, I.I. (A. M., Gor'kii Khar'kov State University). Sov. Phys.–Solid State 16: No. 5, 819-822 (Nov 1974).

The energy spectrum of elementary excitations in a spherical superconducting inclusion is found. The dependence of the superconducting transition temperature on the radius of the spherical inclusion due to quantization of the radial component of the momentum is found. The effect of surface roughness on the relation between critical temperature and radius is taken into account. (auth)

12739 STRAIN DEPENDENCE OF T_c FOR NIOBIUM AND LEAD. Smith, T. F. (CSIRO National Standards Lab., Sydney). J. Low Temp. Phys.; 17: No. 3-4, 323-329(Nov 1974).

Recent measurements of the elastic constants at temperatures close to T_c for niobium and lead would indicate strong individual quadratic strain dependences $\partial^2 T_c/\partial\epsilon_i\,\epsilon_j$, which combined would predict a considerable P^2 contribution to the pressure dependences of their superconducting transition temperatures. These predictions are in conflict with the direct experimental observations of the variation of T_c with pressure to 25 kbar, which exhibit no evidence of any significant quadratic component. The implications of this discrepancy are discussed. (auth)

12740 PROPERTIES OF A SUPERCONDUCTING FILM IN A PERPENDICULAR MAGNETIC FIELD. Conen, E.; Schmid, A. (Univ., Dortmund, Ger.). J. Low Temp. Phys.; 17: No. 3-4, 331-340(Nov 1974).

On the basis of the Ginzburg–Landau free energy, the magnetization and the shear modulus of the vortex lattice is calculated for various values of the Ginzburg–Landau parameter k and of the film thickness. Agreement is found with recently measured values of the shear modulus. (auth)

12741 EFFECT OF NEUTRON IRRADIATION DAMAGE ON THE MAGNETIC BEHAVIOR OF SUPERCONDUCTING NIOBIUM IN ALTERNATING FIELDS. van der Klein, C. A. M.; Kes, P. H.; van Beelen, H.; de Klerk, D. (Univ. of Leiden). J. Low Temp. Phys.; 17: No. 3-4, 295-322(Nov 1974).

Alternating field permeability experiments are reported on superconducting niobium samples irradiated with fast neutrons at reactor ambient temperatures. The results are compared with theoretical predictions derived from several critical state models. Fundamental differences are observed, even when the static magnetization curves are described quite well by the same model. This leads to the conclusion that for small periodic movements of the flux lattice the vortices are not in the critical state. (auth)

12742 EXPERIMENTAL STUDIES OF SUPERCONDUCTING RINGS CONTAINING A SINGLE WEAK LINK. Vincent, D. A. Charlottesville, VA; Univ. of Virginia (1974). 146p. University Microfilms Order No. 74-27,530.

Thesis (Ph. D.).

The phenomena associated with weakly-linked superconductors, generally referred to as the "Josephson effects," form the basis for the research reported, which is concerned both with studies of the properties of the region of weakened superconductivity (the weak link), and with the application of weakly-linked superconductors to magnetometers. In the experiments the response of superconducting rings containing a single weak link were studied in response to applied steady and time-varying magnetic fields. There are several phases of this research, including development of magnetometer sensors and measuring instruments culminating in a novel two-cavity toroidal device capable of extremely sensitive magnetic field measurements when operated in either the usual dissipative flux jump mode or in the continuous inductive mode. These instruments were used to measure the magnetic characteristics of various systems including detailed mapping of quantized flux trapped in superconducting cylinders, magnetization of superconducting layered compounds, and magnetic susceptibility of biological materials. Detailed analyses of the operation of magnetometers (rf SQUID's) and a study of the current-phase relations and representative equivalent circuit models of weakly-linked superconductors constituted a major part of this research. These studies led to impedance measurements of phase-biased weak links culminating in the first observation of the phase-dependent conductivity in a point contact in agreement with the theoretical prediction of Josephson's calculations. From these measurements the ratio of conductivity coefficients $\alpha \equiv \sigma_1/\sigma_0$ was found to be ~ -1 at 4.2 K. (Diss. Abstr. Int., B)

12743 THERMODYNAMIC PROPERTIES OF SUPERCONDUCTORS WITH PARAMAGNETIC ADMIXTURE UNDER PRESSURE. Palistrant, M. E.; Trifan, A. T. (Inst. of Applied Physics, Kishinev, USSR). Teor. Mat. Fiz.; 21: No. 2, 279-295(Nov 1974). (In Russian).

Effect of the Van Hove singularities in the density of the electron states on critical temperature T_c, ordering parameter Δ and energy gap Ω_g of a superconductor with paramagnetic admixture is investigated. Behavior of the quantities listed as functions of pressure and admixture is studied. The value of T_c, Δ and Ω_g depend strongly on the difference of valencies of the admixture atoms and metal atoms. Critical concentrations of the admixture Γ_{cr} and $\Gamma\,\Omega_g = 0$ may increase or decrease with increasing of the pressure, respective of the type of topological change of the Fermi surface. The quantities Γ_{cr} and $\Gamma\,\Omega_g = 0$ are not universal, but depend strongly on the difference of valencies of the admixture atoms and metal atoms. Expressions for thermodynamic critical field at $T = 0$ and $T = T_c$ are obtained the discontinuity of the specific heat at the critical point $T = T_c$

is calculated. Due to taking into account the Van Hove singularities in the electron density of states, the quantities mentioned possess the dependence on the pressure and the additional dependence on the admixture. (auth)

12744 HYPOTHESIS CONCERNING THE POSSIBLE EFFECT OF NONEQUILIBRIUM HIGH TEMPERATURE SUPERCONDUCTIVITY. Brandt, N. B.; Tolmachev, V. V. (Moscow State Univ.). JETP Lett. (USSR) (Engl. Transl.); 19: No. 7, 237-238(5 Apr 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 7, 439-442(5 Apr 1974).

A hypothesis concerning a possible effect of nonequilibrium high-temperature superconductivity is described. Studies of solutions of Na in ammonia, of (TTF), (TCNQ), and of chalcopyrite $CuFeS_2$ are discussed. (auth)

12745 c^2 CONTRIBUTIONS TO THE ABRIKOSOV–GOR'KOV THEORY OF SUPERCONDUCTORS CONTAINING MAGNETIC IMPURITIES. Rainer, D. (Kernforschungsanlage, Juelich, Ger.). pp 593-594 of Low Temperature Physics: LT 13. Vol. 2. Timmerhaus, K. D.; O'Sullivan, W. J.; Hammel, E. F. (eds.). New York; Plenum Publishing Corp. (1974).

From 13th international conference on low temperature physics; Boulder, Colorado, USA (21 Aug 1972). See CONF-720833-(P2).

PHYSICS (NUCLEAR)

12746 (INDC(CCP)-36/U) NUCLEAR PHYSICS RESEARCH IN THE USSR. Collected Abstracts, Issue 16. Oct 1974. Translated from Russian. 29p. Dep. NTIS (U. S. Sales Only) $4.50.

Nineteen abstracts or summaries of papers on nuclear physics research in the USSR are presented. Many different subject areas are represented, including reactions, fission, neutron transport, neutron activation, and reactors. Some of the papers have already been submitted to international journals. (RWR)

12747 (INIS-mf-1477) AEB-HIGHLIGHTS. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Dec 1973. 6p. (In Afrikaans). INIS.

AFB Highlights is a half-yearly report reflecting the most important recent achievements of the various Research and Technical Divisions of the Atomic Energy Board. (INIS)

12748 (INIS-mf-1499) ANNUAL REPORT OF THE DEPARTMENT OF ATOMIC ENERGY, 1973–1974. (Department of Atomic Energy, Bombay (India)). 176p. INIS.

The significant research and development work carried out by the various units of the Department of Atomic Energy (DAE), India, such as the Bhabha Atomic Research Centre, Bombay; the Reactor Research Centre, Madras; the Nuclear Fuel Complex, Hyderabad; the Variable Energy Cyclotron, Calcutta; etc., and the progress made in respect to nuclear power stations are highlighted. The two notable achievements in the direction of progress towards strengthening the technological infrastructure in the country, viz. the indigenous manufacture of the fuelling machine head for the second unit of the Rajasthan Atomic Power Project and the installation of the first India-made reactor vessel, the Calandria, for the unit-II of the same project, have been reported. The increasing applications to which radioisotopes have been put in the fields of nuclear medicine, biology and agriculture have been explained. The reorganization of the Bhabha Atomic Research Centre into seven major groups to facilitate the smooth flow of its activities has been mentioned. The progress of work in the various divisions of the Centre has been outlined. The advancement made in the fields of High Altitude Research and Electronics which are note-worthy has been reported. The work done by the Health Physics Division and the Directorate of Radiological Protection in conducting surveys, etc., has been summarized. The role played by the industries in helping the Department of Atomic Energy in all its endeavours is also explained. The training facilities for personnel of different disciplines, provided by the DAE, the role played by the Atomic Power Authority in the planning of the activities of the DAE and the appreciable increase in the output of the Indian Rare Earths, etc., have been touched upon. The various facets of the future programme of the DAE have been indicated. India's participation in the various international fields has been brought out. (INIS)

Neutron Interactions with Matter

Refer also to abstracts 12109, 13037, and 13041.

12749 (ANL-8126) APPLICATIONS OF FINITE ELEMENT METHODS IN REACTOR MATHEMATICS. Numerical Solution of the Neutron Transport Equation. Kaper, H. G.; Leaf, G. K.; Lindeman, A. J. (Argonne National Lab., Ill. (USA)). Oct 1974. Contract W-31-109-eng-38. 94p. Dep. NTIS $5.45.

The results of a study of the applicability of several classes of finite-element approximation procedures for the numerical solution of the static multigroup neutron transport equation on two-dimensional reactor configurations are given. The procedures are based on a variational formulation of the self-adjoint form of the one-group transport equation. Approximating subspaces are generated by taking the tensor product of a finite-dimensional subspace over the spatial domain and a finite-dimensional subspace over the angular domain. The procedures are applied to a k_{eff} calculation for a multizone reactor configuration with six energy groups. The results indicate that the use of high-order approximation procedures, based on finite element methods and applied to the self-adjoint form of the transport equation, does not provide a viable alternative to the use of discrete ordinate methods, applied in combination with either finite difference or finite element methods to the standard form of the transport equation. (9 figures, 12 tables) (auth)

12750 (AWRE-O-41/74) PANDIT: A FORTRAN IV PROGRAM TO PRODUCE AN ADJUSTED NUCLEAR DATA INPUT TAPE. Dugan, K. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Oct 1974. 13p. Dep. NTIS (U. S. Sales Only) $4.00.

PANDIT is a Fortran IV program to compute adjusted basic nuclear data from the evaluated microscopic cross section data contained in the UK Nuclear Data Library and group cross section adjustment factors generated during the production of group cross section data which give good agreement with integral results. A description is given of the input and output schemes and operating procedures for the IBM 370/165, together with the method of calculation used by the program. (auth)

12751 (BNWL-1833) NEWIGL: A TWO-GROUP TIME-DEPENDENT ONE-DIMENSIONAL NEUTRON DIFFUSION THEORY CODE. Heeb, C. M.; Porath, W. W.; Toffer, H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). May 1974. Contract AT(45-1)-1830. 247p. (UNI-203). Dep. NTIS $7.60.

NEWIGL is the generic name of two similar improvements on the WIGL2 code. NEWIGL solves the one-dimensional two-energy group time-dependent diffusion theory equation with thermal feedback as does WIGL2; however, a stand-alone one-dimensional steady-state diffusion theory code has been added at the front end to perform critical searches and to calculate initial direct and adjoint fluxes. The code will solve problems in slab, cylindrical and spherical geometries with up to six delayed-neutron groups. Thermal feedback is introduced through the solution of the non-boiling heat transfer equations. Transients can be initiated either from changes in the thermal hydraulic parameters or by simulated control rod movement in either of the two independent pseudorod models. Effects of two and three dimensions can be simulated through the use of interpolation tables for control rod worths and Doppler weighting factors. The numerical techniques used for solving the time-dependent diffusion theory equation are the same as in WIGL2. Principal improvements to these have been through the introduction of Doppler weighting factors and control rod worth functions which allow nonlinear changes in control region cross sections as functions of rod position. Values of the Doppler weighting factors and rod worth functions are entered in tabular form. Lagrangian interpolation is used to arrive at intermediate values of the argument required during execution. The NEWIGL programs are entirely independent of auxiliary programs. The CDC 6600 version central memory size is within 57000 locations. The UNIVAC 1108 version is within 63000 locations. Storage is dynamically allocated by the code. A CDC 6600 version problem with 111 mesh points, 6 delayed-neutron groups, and 13 materials took 0.83 seconds per time step. A UNIVAC 1108 version problem with 141 space points, 6 delayed-neutron groups, and 4 materials took 1.17 seconds per time step. Both versions are essentially one hundred percent FORTRAN IV. The CDC 6600 version is operable on the SCOPE 3.5 operating system. The UNIVAC 1108 version is operable on the UCC modified EXEC II operating systems. The CDC version requires 57000 central memory locations plus the normal compliment of disc storage devices. The 1108 version requires 63000 core memory locations plus the normal user scratch drum storage. Required peripheral storage is allocated by both versions during execution. (RWR)

12752 (INDC(CCP)-38/U, pp 1-8) PROVIDING NUCLEAR DATA FOR FAST REACTOR CALCULATIONS. Nikolaev, M. N. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

The problems of a nuclear data service in providing data for fast-reactor calculations are considered. The steps necessary to provide reliable data are listed. The SOKRATOR system was developed to perform the following functions: storage of recommended nuclear data on magnetic tape, transformation of recommended nuclear data into forms suitable for compilation, calculation of microscopic reactor constants, and determination of macroscopic constants. (RWR)

12753 (LA-5687) PENDF: A LIBRARY OF NUCLEAR DATA FOR MONTE CARLO CALCULATIONS DERIVED FROM DATA IN THE ENDF/B FORMAT. LaBauve, R. J.; Weisbin, C. R.; Seamon, R. E.; Battat, M. E.; Harris, D. R.; Young, P. G.; Klein, M. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Jul 1974. Contract W-7405-eng-36. 174p. Dep. NTIS $7.60.

A specialized pointwise evaluated nuclear data library in a format suited for input to continuous energy Monte Carlo codes was developed from the ENDF/B at the Los Alamos Scientific Laboratory. Prominent features of the data for a particular nuclide are as follows: (1) A complete description of all alterations made to the original ENDF/B data is contained in the file. (2) All resonance parameters are processed into pointwise cross-section data for a specified temperature. (3) The cross-section data for all reactions are placed on a common energy mesh sufficiently dense to allow linear–linear interpolation between points to some

specified tolerance. Excess data points are thinned to a specified tolerance. (4) Angular distributions of secondary neutrons are expressed as scattering angle cosine vs probability tabulation in which the angle cosine points are given at equal probability intervals. (5) If the energy distribution of secondary neutrons is expressed as a tabulation of secondary energy vs probability in the the original ENDF/B file, the secondary energy points are also recalculated at equal probability intervals as in (4). (6) All gamma-ray production cross sections and gamma-ray spectra are summed and expressed as a single isotropic, nonelastic reaction. The gamma-ray production cross sections are given on the same energy mesh as the other reactions. (10 figures, 7 tables) (auth)

12754 (ORNL-TM-4235) APPLICATION OF A DISCRETE-ENERGY, DISCRETE-ORDINATES TECHNIQUE TO THE STUDY OF NEUTRON TRANSPORT IN IRON. Ching, J.; Goldstein, H.; Oblow, E. M. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 124p. Dep. NTIS $5.45.

Thesis. Submitted by J. Ching to Columbia Univ., New York.

An algebraic equivalence between the point-energy and multigroup forms of the Boltzmann transport equation is demonstrated which allows the development of a discrete-energy discrete-ordinates method for the solution of radiation transport problems. The method utilizes a modified version of a cross-section processing scheme devised for the moments method code BMT and the transport equation solution algorithm from the one-dimensional discrete-ordinates transport code ANISN. The combined system, identified as MOMANS, computes fluxes directly from point cross sections in a single operation. In the cross-section processing, the group averaging required for multigroup calculations is replaced by a fast numerical scheme capable of generating a set of transfer cross sections containing all the physical features of interest, thereby increasing the detail in the calculated results. Test calculations in which the discrete-energy method was compared with the multigroup method have shown that, for the same energy grid (number of points = number of groups), the discrete-energy method is faster but somewhat less accurate than the multigroup method. However, the accuracy of the discrete-energy method increases rapidly as the spacing between energy points is decreased, approaching that of multigroup calculations. For problems requiring great detail in the energy spectrum the discrete-energy method has therefore proven to be as accurate as, and more economical than, the multigroup technique. This has been demonstrated by the application of the method to the study of the transport of neutrons in an iron sphere. By using the capability of the discrete-energy method for rapidly treating changes in cross section sets, the propagation of neutrons from a 14-MeV source in a 22-cm radius sphere of iron was analyzed for sensitivity to changes in the microscopic scattering mechanisms. (32 figures, 14 tables) (auth)

12755 (PTB-FMRB-52) MEASUREMENT OF THE REFLECTION CAPACITY OF MOSAIC CRYSTALS FOR THERMAL NEUTRONS. Erdmann, K. D. (Physikalisch-Technische Bundesanstalt, Braunschweig (F.R. Germany). Forschungs- und Messreaktor). May 1974. 75p. (In German). Dep. NTIS (US Sales Only) $6.75.

Thesis. Submitted to Technische Univ. Braunschweig.

After a brief introduction, crystal structure and Bragg reflection are discussed, along with the reflection capability of a plate-like single crystal. Then the experimental setup and measuring method are described. Calculation of the Rocking curves is explained, including the general derivation, backscattering in a Si test crystal, and transmission in a Pb test crystal. Finally, the investigation of several Si and Pb single crystals is recounted. Comparison of the measured with the calculated Rocking curves showed that the measured reflection capacities were smaller than was expected theoretically. (21 figures, 2 tables) (RWR)

12756 (UCRL-50400(Vol. 1)(Rev.2)) ECSIL: A SYSTEM FOR STORAGE, RETRIEVAL, AND DISPLAY OF EXPERIMENTAL NEUTRON DATA. Cullen, D. E.; Hill, K. L.; Howerton, R. J.; Perkins, S. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Mar 1974. Contract W-7405-eng-48. 73p. Dep. NTIS $5.45.

A description of the experimental cross section information library (ECSIL) as of March 1, 1974 is presented, together with its associated formats, conventions, and supporting programs. The forms (i.e., plots and listings) and the order in which data and bibliographic information may be obtained are also given. (10 figures, 12 tables) (auth)

12757 TWO-MEDIA SOLUTIONS TO THE NEUTRON TRANSPORT EQUATION. Stewart, J. E. III. Charlottesville, VA; Univ. of Virginia (1974). 276p. University Microfilms Order No. 74-23,263.

Thesis (Ph. D.).

The basis analysis and application of the singular eigenfunction expansion approach to solution of the neutron transport equation for problems involving two neutron transport media are described. Rigorous expressions are obtained for the neutron distributions and criticality conditions for the one-speed critical reflected slab problem and for the more complex two-speed critical reflected slab cell problem. The one-speed solution is the first which places no restriction on the system dimensions. The two-speed solution is the first for a two-media problem. The rigorous expressions involve expansion coefficients which are specified by coupled sets of integral equations, some of which are singular. Numerical studies compare the rigorous solution criticality results, which are precise enough to serve as analytical standards, with those of several approximate methods of solution. Conclusions as to the ranges of validity of the approximate solutions are drawn. (Diss. Abstr. Int., B)

12758 APPLICATION OF THE PROBABILITY TABLE METHOD TO MULTIGROUP CALCULATIONS OF NEUTRON TRANSPORT. Cullen, D. E. (Univ. of California, Livermore). Nucl. Sci. Eng.; 55: No. 4, 387-400(Dec 1974).

The probability table method, developed for Monte Carlo calculations in the region of unresolved neutron resonances, is demonstrated to be of general use in neutron transport studies, since the Boltzmann equation involved can be derived and solved by analogy to multigroup methods. Since the resulting equations can be cast into a form identical to that of the multigroup equations, they can be solved by existing multigroup transport codes. From a set of probability tables and spatially independent, unshielded neutron cross sections, the method yields correct self-shielding effects, such as equivalent, spatially dependent multigroup cross sections. Extension of the method and the use of probability tables outside the unresolved region are discussed. (10 figures, 2 tables) (auth)

12759 IMPROVEMENTS IN TRANSPORT THEORY AND THEIR APPLICATIONS TO FAST NEUTRON SPECTRA. Ginsberg, A. P. Troy, NY; Rensselaer Polytechnic Inst. (1973). 275p. University Microfilms Order No. 74-26,076.

Thesis (Ph. D.).

Improvements are made in S_N transport theory and in the calculation of anisotropic group constants. Weighted differencing and a more rigorous treatment of the scattering source are used in the solution of the transport equation. A weighting scheme is developed and used in the calculation of group constants, including the weighting of the Legendre moments of the scattering cross section with recursively generated Legendre moments of the flux. Widely used standard computer codes are modified to include these improvements. Comprehensive testing is done to determine the best parameters, including choice of quadrature and order of anisotropic scattering, for a precise but economical calculation of fast-neutron spectra. An important application of a high-order transport calculation is the comparison with integral spectrum measurements, such as those done at Rensselaer, to determine basic cross section discrepancies. The use of an energy-dependent transport theory with anisotropy in both flux and scattering reduces the uncertainties in the theoretical calculation, and allows differences in the theory–experiment spectra comparisons to be attributed mainly to the cross sections. Spectra calculations that include high-order anisotropic scattering are compared with the results of integral experiments on uranium, iron and aluminum, and the ENDF/B files for these elements are assessed. Differences among cross section files for the same element are emphasized. (Diss. Abstr. Int., B)

12760 APPLICATION OF CONTINUOUS SLOWING DOWN THEORY TO THE CALCULATION OF SPACE DEPENDENT SPECTRA. Epstein, G. H. Troy, NY; Rensselaer Polytechnic Inst. (1974). 175p. University Microfilms Order No. 74-26,071.

Thesis (Ph. D.).

Two analytical procedures for analyzing space-dependent slowing down were developed and applied with good results over the energy range of interest in fast reactors. In the first procedure the standard slowing-down equations are modified by the inclusion of collision probabilities to describe the transfer of neutrons across boundaries and by redefining the slowing-down parameters in terms of a separable kernel in order to include inelastic scattering. Space-dependent spectra calculated by this procedure for both single-region and two-region systems involving iron and depleted uranium (U^{238}) are in good agreement with transport theory results. One limitation of the present analysis is its tendency to under-predict the fluxes of groups lying below the 26-keV iron resonance in finite slab assemblies of iron which are 20 cm or less in depth. The separable kernel CSDT procedure can be readily adapted to the calculation of space-dependent spectra in reactor core–reflector problems, heterogeneous cell calcu-

lations, and blanket–reflector–coolant problems as well as to a wide variety of single-material shielding problems. In addition, the procedure can be used for calculating weighting functions for generating space-dependent broad group cross section sets for use in analyzing deep penetration experiments and two-region fast spectra experiments. In the second procedure, age theory was modified by incorporation of an explicit integrable first collision source into the age integral and by inclusion of a last-flight correction on the age τ. These modifications have extended the range of validity of ordinary age. Efforts to apply this formalism to two-region problems by semi-analytic, or intuitive, procedures were not productive. (RWR)

12761 ENERGY TRANSFER TO HYDROGEN BY NEUTRONS UP TO 30 MeV. Fleming, R. F. (Univ. of Michigan, Ann Arbor). Radiat. Res.; 60: No. 2, 347-349(Nov 1974).

Calculations of energy transfer (kerma) for neutrons from 0.1 MeV to 30 MeV are presented for hydrogen based on the differential elastic scattering cross sections of Hopkins and Breit. This work is a recalculation of the tabulation of Bach and Caswell based on these more recent cross sections. The value of the kerma reaches a maximum at about 16 MeV and decreases slowly at higher energies. (auth)

12762 RECURRENCE FORMULA FOR NUMERICAL SOLUTION OF SLOWING DOWN EQUATION WITH P_1 APPROXIMATION. Ohkubo, Y.; Ishiguro, Y.; Tsuruta, S. I. (Japan Atomic Energy Research Inst., Tokai). J. Nucl. Sci. Technol. (Tokyo); 11: No. 8, 348-352(Aug 1974).

Detailed knowledge of the fast-neutron spectrum is important for the calculation of group constants and reaction rates in a fast reactor. The basic equation describing neutron slowing-down contains integral terms representing the contributions due to neutrons scattered from other energies. A purely numerical approach using the recurrence formula has been developed for evaluation of the scattering integral; however, isotropic scattering was assumed. The purpose of this work was to derive the recurrence formula for scattering integrals with P_1 anisotropy in both center-of-mass and laboratory systems. The discussion is restricted to elastic scattering. A calculation was done for a homogeneous medium of Fe_2O_3 with $B_2 = 0.003$. The fast-neutron spectrum in this system and P_1 component of the ^{16}O scattering angular distribution in the center-of-mass system are shown. (1 figure) (RWR)

12763 EFFECT OF DIFFUSION COEFFICIENT COLLAPSING ON NEUTRON MULTIPLICATION FACTOR. Takeda, T.; Takeda, S. (Hitachi Ltd., Kawasaki, Japan). J. Nucl. Sci. Technol. (Tokyo); 11: No. 8, 356-357(Aug 1974).

In current diffusion codes, the neutron flux is adopted as weighting function instead of the neutron current to collapse even the diffusion coefficient. In few-group theory the choice of weighting function can markedly affect the multiplication factor. The effect of the number of groups is examined for a PuO_2–UO_2-fueled, sodium-cooled prototype fast reactor is examined analytically. The calculations are performed in one-dimensional cylindrical geometry with the ABBN-type 26-group cross-section set. The neutron spectrum obtained from the 26-group calculation was used to collapse the neutron diffusion parameters into few groups. The linearity of Δk against $1/N^2$ was clearly indicated, and it was found that the error brought to the neutron multiplication factor by the adoption of a coarse energy mesh can be quite significant, amounting to 1% Δk in the case of one-group theory as compared with a 26-group calculation. From the figure given one can predict the exact value of the neutron multiplication factor from a few-group calculation and the error contained in the multiplication factor calculated by few-group theory. (1 figure, 1 table) (RWR)

12764 ANALYSIS OF FAST NEUTRON PULSE BY SUPERPOSITION OF WAVE MODES. Hino, T. (Hitachi Ltd., Kawasaki, Japan); Ozawa, Y. J. Nucl. Sci. Technol. (Tokyo); 11: No. 4, 119-124(Apr 1974).

Phenomena engendered by the fast neutron pulse are analyzed by Neumann series solution of the reduced three-dimensional neutron transport equation. The spectral functions of collision neutron fluxes are derived by Fourier-Laplace transform, and the time-, space-, and energy-dependent collision neutron fluxes possessing definite wave fronts are obtained by using convolution theorems in Fourier–Laplace analysis. Thus, the behavior of fast neutron pulses is described in terms of a superposition solely of wave modes. The present study has deepened our understanding of the detailed physical process of fast neutron pulses, and the process of their formation on the asymptotic mode is clearly explained by wave processes. This treatment has provided a clear explanation of the short-time phenomena shown by pulsed neutrons, and should prove useful for analyzing situations where the continuous mode prevails over the asymptotic mode. An experiment of nanosecond order on fast-neutron pulses is also analyzed. (auth)

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Refer also to abstracts 12806, 12878, 12966, and 12981.

12765 (HU-TFT-74-6) EFFECT OF THE Δ(1236) ON THE CHARGE FORM FACTOR OF ^3He AND ^3H. Kallio, A. J.; Toropainen, P.; Green, A. M.; Kouki, T. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Mar 1974. 43p. Dep. NTIS (US Sales Only) $5.25.

The Δ(1236) is introduced into the wave functions of ^3He and ^3H and the charge form factor calculated. The effect is to slightly aggravate the already large discrepancy between theory and experiment for $q^2 \gtrsim 14$ fm^{-2}. However, there are two side benefits–a simple way to understand the d-wave contribution to the CFF, and a simple NΔ correlation function having a very good overlap with a more exact correlation. (auth)

12766 (JINR-P4-8158) COUPLING CONSTANT Tdn FOR THE BRESSEL–KERMAN–ROUBEN POTENTIAL. Belyaev, V. B.; Irgaziev, B. F.; Orlov, Yu. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

The coupling constant G^2 and the form factor for the vertex $T \rightarrow d + n$ are calculated using the wave function found by solving the Faddeev equations with the modified Bressel–Kerman–Rouben potential. The result for the coupling constant ($G^2 \approx 1$ fm) actually coincides with the experimental data. For accurate G^2 evaluation one should carefully calculate the three-nucleon wave function for the momentum unphysical region. (auth)

12767 (ORO-1316-183) NUCLEAR PHYSICS PROGRESS REPORT, APRIL 1, 1974–March 31, 1975. Phillips, G. C. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). 1974. Contract AT(40-1)-1316. 15p. Dep. NTIS $4.00.

During the year progress was made in the following areas of pure and applied physics: Neutron Physics, Few-Body Problems, Polarization Studies, Nuclear Theory, Applied Areas of Bio-Medical Physics, and Instrumentation. Plans were developed for phasing out the project in the next year. (auth)

12768 (ORO-1316-184) NUCLEAR STRUCTURE AT INTERMEDIATE ENERGIES. Progress Report, April 1, 1974–March 31, 1975. Phillips, G. C. (Rice Univ., Houston, Tex. (USA). Bonner Nuclear Labs.). 1974. Contract AT(40-1)-1316. 18p. Dep. NTIS $4.00.

During the year 1974 the program goals of carrying out experimental and theoretical studies in intermediate energy physics were continued. The Rice University Portable Laboratory was at LAMPF until October, 1974, at SREL until November, 1974, and then returned to Houston. At LAMPF several experiments were accomplished: completion of the tune-up of the P^3 pion beam; the first phase of experiment 80: π^+ small-angle scattering from ^{12}C, ^{40}Ca, and ^{208}Pb, and total cross sections; and the first phase of experiment 81, pd → ppn two-arm coincidence studies of final-state interactions and quasi-free scattering, and pp → NNπ. Experiment 84 was initiated. At SREL two experiments were carried out with a two-arm apparatus: additional studies of pd → ppn and initiation of pd → πdn studies. During the year the PDP-11/20 was upgraded to PDP-11/45, and a new CAMAC readout system for multi-wire proportional counters was put in service. (6 figures) (auth)

12769 CORRELATION STUDY OF THE BREAK-UP OF TRIONS INDUCED BY 45 MeV PROTONS. Tin, E. S. Y. Winnipeg, Manitoba; Univ. of Manitoba (1974). vp. Univ. of Manitoba, Winnipeg.

Thesis (Ph. D.).

The $^3H(p,2p)nn$, $^3H(p,pd)n$, $^3He(p,2p)d$ and $^3He(p,2p)pn$ reactions were studied at an incident proton energy of 45 MeV at a variety of coplanar symmetric and asymmetric angle pairs. Momentum distributions of the d and [nn] systems in ^3H and of the d and d* systems in ^3He were extracted within the framework of the plane-wave impulse approximation (PWIA). d* and [nn], respectively, refer to n–p and n–n pairs with low energy for their relative motion. Good agreement can be obtained for the shape of the momentum distributions if an Irving–Gunn wave function is used for the tri-nucleon (trion) system. However, a cut-off radius is found to be necessary for the reactions $^3H(p,pd)n$ and $^3He(p,2p)d$. The shape of the angular correlation momentum distribution for the $^3H(p,2p)[nn]$ reaction is sensitive to the approximation used for the off-the-energy-shell scattering amplitude. The PWIA predicts cross sections which are typically a few times greater than the experimental ones; this result indicates the presence of multiple scattering effects. Shifts are observed in the positions of the quasi-free scattering peaks in the $^3H(p,pd)n$ reaction which

might be attributable to the neutron pick-up process. The Watson–Migdal model fails to explain the final-state interaction between the unobserved pair of nucleons for both the ^{3}H(p,2p)nn and ^{3}He(p,2p)pn reactions. Comparison of the continua for the ^{3}H(p,2p)nn reaction with four-body differential phase space distributions shows no evidence for a resonance in the ^{3}H system but reveals some hitherto unobserved pseudo two-body processes, namely the p–d* quasi-free scattering process and the p + t → d* + d* reaction. (Diss. Abstr. Int., B)

12770 THREE-NUCLEON SYSTEM. Tjon, J. A. (Univ., Utrecht). Czech. J. Phys.; 24: No. 11, 1216-1224(1974).

A brief review is given of the recent progress made in the study of the three-nucleon problem with local interactions. In particular, it is pointed out that the presence of meson exchange currents can contribute significantly to the ^{3}He charge form factor at high momentum transfer. (auth)

12771 THREE-NUCLEON CALCULATIONS FOR LOCAL POTENTIALS WITH THE QUASIPARTICLE METHOD. Alt, E. O. (Univ., Mainz). Czech. J. Phys.; 24: No. 11, 1225-1231(1974).

The three-nucleon system for energies below the breakup threshold is investigated with the help of the quasiparticle method. Two types of local potentials are used, namely purely attractive Yukawa potentials and the soft-core potentials of Malfliet and Tjon. The results obtained are compared with those of other calculations employing different methods. (auth)

12772 HOW THE 3-NUCLEON SYSTEM DEPENDS ON THE 2-NUCLEON POTENTIALS. Ebenhoeh, W. (Univ., Heidelberg). Czech. J. Phys.; 24: No. 11, 1232-1242(1974).

Recent theoretical and experimental results on the 3-nucleon systems are analyzed as a possible source of information about the force acting inside a nucleon pair. (auth)

12773 INELASTIC FORM FACTOR AND THREE-BODY FORCES IN THE HYPERSPHERICAL DESCRIPTION OF ^{4}He. Zofka, J.; Sotona, M. (Inst. of Nuclear Physics, Rez, Czech.). Czech. J. Phys.; 24: No. 11, 1250-1254(1974).

The inelastic form factor for the A(e, e')A* scattering is used to establish a link between the higher solutions of the hyperradial equation with $K = K_{min}$ and the excited states, A*. A satisfactory description of the 0^+ (20.1 MeV) state in ^{4}He was found. The influence of effective Gaussian three-body forces on excitation energies, radii and elastic and inelastic form factors of ^{4}He was studied. It is noticed that a two-body force cannot simulate completely a three-body one. (auth)

12774 OPTICAL MODEL FOR PION ELASTIC SCATTERING BY NONZERO SPIN AND ISOSPIN NUCLEI. Mach, R. (Inst. of Nuclear Physics, Rez, Czech.). Czech. J. Phys.; 24: No. 11, 1305(1974).

In the framework of the Watson multiple scattering theory, the first order optical potential was derived for pion elastic scattering by nonzero and isospin nuclei. Using the above described potential an analysis of the pion elastic scattering by helium-3 was performed. (JFP)

12775 APPLICABILITY OF BRUECKNER THEORY TO TRINUCLEON AND ^{4}He. Sotona, M. (Inst. of Nuclear Physics, Rez, Czech.). Czech. J. Phys.; 24: No. 11, 1308-1310(1974).

Reaction matrix calculations were performed for a number of nonlocal separable potentials for which the integral equations for tritium and alpha particles were solved. The resulting values of the binding energies for these nuclei using the Brueckner theory with common approximations differ within 5 to 6% from the exact values obtained by solving Faddeev and Yakubovsky–Faddeev equations. It is concluded that Brueckner theory of the reaction matrix can yield binding energies of light nuclei with sufficient accuracy. (JFP)

12776 DETERMINANTAL METHOD FOR BOUND STATES AND RESONANCES OF THREE-PARTICLE SYSTEMS. Newton, R. G. (Indiana Univ., Bloomington). Czech. J. Phys.; 24: No. 11, 1195-1204(1974).

Bound state energies, positions and widths of resonances of two-particle systems may be calculated as zeros of an analytic function of the energy, the modified Fredholm determinant of the Lippmann-Schwinger equation. This generates degenerate perturbation theory particularly easily. The method is generalized to the three-body problem. Here too, the bound states and resonances appear as zeros of an analytic function of the energy, the modified Fredholm determinant of a square-integrable kernel. It is proved that the multiplicity of a zero equals the degeneracy of the corresponding eigenvalue. (auth)

12777 DECAY OF NEUTRON YIELD FROM TITANIUM-TRITIDE TARGETS. Ormrod, J. H. (Chalk River Nuclear Labs., Ont.). Can. J. Phys.; 52: No. 20, 1971-1980(15 Oct 1974).

A model for the decay of neutron yield from titanium-tritide targets is proposed based on the collisional displacement of tritium atoms by the incoming deuteron beam. The cross section for these displacement collisions is derived. The decay predicted by the model is in good agreement with experiments on several targets. The model predicts the improved lifetime of targets when they are bombarded by an analyzed deuteron beam. (auth)

12778 WEAK PARITY–NONCONSERVING POTENTIALS AND CIRCULAR POLARIZATION OF n–p CAPTURE GAMMA RAYS. Rustgi, M.L. (Physics Department, State University of New York, Buffalo, New York 14214); Pirner, H.J. Phys. Rev. C 10: No. 5, 2099-2101 (Nov 1974).

Employing different models of the weak parity–violating vector–meson exchange potentials and three versions of the parity–conserving nucleon–nucleon potentials, namely Hamada–Johnston, Yale, and modified Yale, the circular polarization of the n–p capture γ rays is calculated and compared with the observed value. (auth)

12779 PSEUDO–RESONANCE BEHAVIOR OF PARTIAL WAVES IN ELASTIC PION SCATTERING. Hoenig, M.M.; Rinat (Reiner), A.S. (Physics Department, Weizmann Institute of Science, Rehovot, Israel). Phys. Rev. C 10: No. 5, 2102-2105 (Nov 1974).

Glauber theory employing observed πN phases is used to compute πd differential cross sections for $E \lesssim 600$ MeV. Lacking experimentally extracted phase shifts, we used the model to construct model phases, which have been plotted in Argand diagrams. These display for many J^π values a pseudo–resonance behavior. It is restressed that these do not correspond to resonances in a B = 2 system but simply reflect a N* in the weakly bound deuteron. (auth)

12780 THREE–BODY FORCE IN THE TRITON. Yang, S. N. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 10: No. 5, 2067-2079 (Nov 1974).

We have derived a two–pion–exchange three–body potential by using a chiral–invariant Lagrangian for the pion–nucleon interaction. Only the three dominant lowest–order processes which give rise to a three–body interaction are included: (a) The second pion is emitted before the first pion is absorbed and the nucleon which emits the second pion goes into a positive–energy state; (b) one nucleon exchanges a ρ meson with a pion; (c) one nucleon is scattered into an N* (1236). We then proceed to evaluate the contribution of this three–body potential to the binding energy of the triton using a variational triton wave function. It is found that the two–pion–exchange three–body potential gives a significant contribution (2.32 MeV) to the binding energy of a triton. (auth)

12781 ELASTIC SCATTERING OF DEUTERONS BY ^{4}He BETWEEN 30 AND 40 MeV. Willmes, H.; Messick, C.R. (University of Idaho, Moscow, Idaho 83843); Cahill, T.A.; Shadoan, D.J.; Hammond, R.G. Phys. Rev. C 10: No. 5, 1762-1766 (Nov 1974).

Differential cross sections for elastic scattering of deuterons by ^{4}He were measured at laboratory energies of 29.8, 32.3, 34.8, 37.3, and 39.8 MeV. The angular range extended from 15 to 160 ° cm in steps of about 5 °. The average relative error was 2%, and the uncertainty in the absolute normalization was 2%. (auth)

12782 STUDY OF THE $\alpha + \alpha$ SYSTEM BELOW 15 MeV (c.m.). Chien, W.S.; Brown, R.E. (John H. Williams Laboratory of Nuclear Physics, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. C 10: No. 5, 1767-1784 (Nov 1974).

Differential cross sections for $\alpha + \alpha$ elastic scattering have been measured at lab energies of 18.00, 21.12, 24.11, 25.50, 26.99, 28.50, and 29.50 MeV. The majority of the data have relative errors less than 1%, and the additional error in absolute scale is 0.30%. A phase–shift analysis of the data has been performed, and most of the phase shifts have been determined to within $\pm 1/3°$. These phase shifts and others from the literature were used to study properties of the $\alpha + \alpha$ system in the center of mass energy range 1.50 to 14.74 MeV. First, an R–matrix analysis was made of the l = 4 phase shifts; this analysis yields a resonance energy of 11.7 ± 0.4 MeV and a level width at resonance of 4.0 ± 0.4 MeV. Second, comparison was made of the $\alpha + \alpha$ phase shifts with results of previous resonating–group calculations, and this comparison shows good agreement with a calculation which includes one inelastic channel and a nucleon–nucleon repulsive core. Third, an $\alpha + \alpha$ potential model was constructed. This model contains an attractive potential obtained by folding Gaussian α–particle densities together with a Yukawa–shaped direct part of a nucleon–nucleon potential and, in addition, contains phenomenological short–range repulsive components in the l = 0 and l = 2 states. The model reproduces the experimental phase shifts quite well when the Yukawa potential is taken to have a range corresponding to a two–pion mass. (auth)

12783 MODEL FOR PHOTONUCLEAR REACTIONS AT INTERMEDIATE ENERGIES. Gari, M.; Hebach, H. (Institut für

Theoretische Physik, Ruhr—Universität Bochum, Bochum, Germany). Phys. Rev. C 10: No. 5, 1629-1639 (Nov 1974).

In the present paper we discuss photonuclear reactions for photon energies $E_\gamma > 50$ MeV. We show in detail how the different processes concerning the nucleon—nucleon interactions enter the transition matrix. Explanations are given for the similar behavior of (γ, n) and (γ, p) and for a strong relative suppression of the reactions (γ, pp) and (γ, nn) compared to (γ, np). This solves the standing problems of photonuclear reactions at intermediate photon energies. We present numerical calculations for the reactions (γ, p) and (γ, n) on ^{4}He from 50 to 140 MeV photon energy and show in detail how the different physical processes numerically enter the total cross sections and angular distributions. Over—all good agreement with the experiments is achieved. (auth)

12784 OFF-SHELL EFFECTS IN THE THREE-NUCLEON SYSTEM. McGurk, N. J. (University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit); Groot, H. de (Vrije Universiteit, Amsterdam (Netherlands). Natuurkundig Lab.). Nucl. Phys., A; 231: No. 2, 233-242(14 Oct 1974).

The triton binding energy and the neutron-deuteron doublet scattering length were studied with phase-equivalent rank-2 separable potentials in S-waves. The potentials were constructed from the phase shifts using the solution of the inverse scattering problem. Large off-shell effects are connected with the appearance of additional nodes in the deuteron or the low energy singlet wave functions. (auth)

12785 CONSTRAINED VARIATIONAL CALCULATIONS OF CLOSED SHELL NUCLEI WITH THE REID POTENTIAL. Pandharipande, V. R. (Illinois Univ., Urbana (USA). Dept. of Physics). Nucl. Phys., A; 231: No. 2, 257-265(14 Oct 1974).

Lowest order constrained variational calculations with harmonic oscillator wave functions are carried out for ^{4}He, ^{16}O, and ^{40}Ca nuclei with the Reid potential. The results obtained with this simple method are in very close agreement with those obtained by renormalized Brueckner-Hartree-Fock theory with orthogonalized plane wave intermediate states. The A-dependence of the difference between the experimental and calculated binding energies for A = 2, 3, 4, 16, 40 and ∞ can be explained by a three-body cluster term coming either from a wrong off-energy-shell behavior of the Reid potential or a three-body force. The calculated radii of ^{16}O and ^{40}Ca are ~10% too small, indicating that the Reid potential may not be very realistic. (auth)

12786 THREE-NUCLEON RESULTS FOR SEPARABLE POTENTIALS MODELLED ON THE REID SOFT-CORE POTENTIAL. McGurk, N. J.; Fiedeldey, H. (University of South Africa, Pretoria). Phys. Lett., B; 52: No. 2, 156-158(30 Sep 1974).

Using a solution to the inverse scattering problem the authors have generated phase-equivalent separable potentials in the $^1S_0$ and $^3S_1-^3D_1$ states, which have nearly the same singlet UPA form factors and deuteron parameters (E_D, P_D, Q_D, A_S and A_D/A_S) as the Reid soft-core potential. The results are compared for the binding energy of the triton and the neutron-deuteron doublet scattering length with the corresponding values for the Reid soft-core potential. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 12553, 12665, 12785, 12818–12820, 12825, 12830, 12833, 12847, 12878, 12879, 12896, 12966, 12981, and 13006–13008.

12787 (AERE-PR/NP-21, pp 29-31) CALIBRATION OF SUB-COULOMB TRANSFER REACTIONS. Hooton, B. W. (Atomic Energy Research Establishment, Harwell, Eng.); Ivanovich, M.; Durell, J. L.; Phillips, W. R.; Buttle, P. J. A.; Goldfarb, L. J. B. Aug 1974.

12788 (JINR-P4-8058) TWO-STEP EFFECTS IN TRANSFER REACTIONS IN THE DISPERSION THEORY. Luk'yanov, V. K.; Titov, A. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Two-step transfer reactions are considered in the framework of the dispersion theory of direct reactions. It is suggested that the two-step effects are connected with a contribution of triangle diagrams with vertexes corresponding to excitation of nuclei in entrance or exit channels. As an example the calculation of the reaction ^{12}C(d,^{3}He)^{11}B is made and the result is compared with experiments. The cross section dependence on the deuteron energy is analyzed. (auth)

12789 (JINR-P15-8072) INVESTIGATION OF PROTON POLARIZATION AT BACK ANGLES IN EXPERIMENT WITH RING GEOMETRY. Krivopustov, M. I.; Sizov, I. V.; Oehler, H. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 19p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An instrument for the investigation of proton polarization at back angles was developed by using the procedure of the polarization experiment in ring geometry. Some aspects of polarimeter development and utilization of ring semiconductor detectors are considered. The results of the measurements on proton polarization in the ^{12}C(^{3}He, p)^{14}N reaction (ground state) for 3.03- and 3.61-MeV accelerated ions show the possibility of studying the polarization of particles at $\theta > 90°$ with the help of this polarimeter. (auth)

12790 (JINR-P15-8186) POSSIBLE METHODS OF STUDYING SHORT-LIVED PRODUCTS OF DIRECT NUCLEAR REACTIONS DECAYING BY EMISSION OF AT LEAST ONE NUCLEON. Zorin, G. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 13p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Possible methods of studying short-lived light isotopes—the products of nuclear reactions—decaying by emission of at least one nucleon are suggested and analyzed. These methods allow, in addition to the reliable identification of the nuclear reaction products, the type of radioactive decay to be determined and its rate to be measured. (2 figures) (auth)

12791 SPONTANEOUS-FISSION HALF-LIFE OF ^{8}Be. Lin, L.; Dreizler, R. M.; Galbraith, H. (Univ., Frankfurt am Main). Lett. Nuovo Cim.; 11: No. 14, 627-630(7 Dec 1974).

It is shown that a standard interpretation of previous results with HF calculations in a two-center model for the system ^{8}Be ≈ 2^{4}He yields a spontaneous-fission half-life for ^{8}Be in very reasonable accord with experiment. (JFP)

12792 ANGULAR CORRELATION STUDY OF THE ^{16}O(^{7}Li, t^{16}O)^{4}He REACTION. Panagiotou, A. D.; Cornell, J. C.; Anyas-Weiss, N.; Hudson, P. N.; Rocha, A. M.; Scott, D. K.; Macefield, B. E. F. (Oxford Univ.). J. Phys., A (London): 7: No. 14, 1748-1757(21 Sep 1974).

Angular correlations between tritons and ^{16}O GS nuclei, produced in the sequential reaction ^{16}O(^{7}Li,t)^{20}Ne*(α)^{16}O, have been measured for a number of levels in ^{20}Ne. The tritons were detected at angles as large as 30° in the laboratory, and the fits to the correlations suggested the existence of a symmetry axis for the decay of the intermediate state ^{20}Ne*. Taking the observed symmetry axis as the axis of quantization, the population of the magnetic substates m = 0, ±1 of levels of ^{20}Ne with known J^π was deduced from the correlations. The data are best fitted by assuming at least 84% population of the m = 0 substate. These observations are consistent with the (^{7}Li,t) reaction being mainly a direct reaction, and consequently it can be used reliably to obtain spectroscopic information. The structure of two states at 12.56 and 15.36 MeV is discussed. (auth)

12793 NEUTRON TRANSFER BETWEEN IDENTICAL CORES. Chua, L. T. New Haven; Yale Univ. (1974). 319p. University Microfilms Order No. 74-25,726.

Thesis (Ph. D.).

Single-neutron transfer between ^{12}C cores in the ^{12}C + ^{12}C interaction was studied both experimentally and theoretically. Advantage was taken of the fact that the identical cores in entrance and exit channels provide an intrinsic amplification of weak transfer amplitudes through interference with the elastic scattering amplitudes as well as marked reduction in the number of relevant model parameters. Elastic and inelastic cross section surfaces were measured on a 0.5 MeV and 1.0° grid in the energy ranges from 20 to 35.5 and 30 to 35.5 MeV, respectively, and in the angular range from 45° to 125° by using a dual position-sensitive detector and on-line computer analysis system to establish reaction kinematics unambiguously. Both elastic and inelastic neutron transfer data were analyzed by using the Source Term Method and including multistep processes in the inelastic channels. The lower energy (15 to 25 MeV) data are reproduced quantitatively by using a Hankel function approximation to the form factor at large radius. At higher energies the calculations systematically predict cross sections smaller than those measured; qualitatively they reproduce the gross features of the measured data. Multiple transfer processes and explicit angular momentum dependence of the interaction potentials were eliminated as possible causes of the quantitative discrepancies, as were compound nuclear interaction amplitudes. These latter were, however, found to be significant. Residual ^{13}C states having predominant single-particle character were found to be populated predominantly via direct (DWBA) amplitudes with higher-order processes reduced by at least a factor

of 10 in intensity. Residual ^{13}C states having predominant collective character can be populated only in higher-order processes; model predictions on this assumption are in good qualitative accord with the experimental data. (Diss. Abstr. Int., B)

12794 POLARIZATION OF NEUTRONS IN n–^{16}O SCATTERING. Hickey, G. T. New Haven; Yale Univ. (1974). 155p. University Microfilms Order No. 74-25,741.

Thesis (Ph. D.).

The polarization of neutrons elastically scattered from ^{16}O at nine angles ranging from 20° to 160° was measured as a continuous function of energy between 1 and 4 MeV by using a neutron double-scattering technique. The neutron energies were determined by using the nanosecond neutron time-of-flight spectrometer associated with the Yale University Electron Linear Accelerator. The primary intense flux of unpolarized neutrons was generated by the photo-disintegration of natural lead and uranium. A fraction of these neutrons was elastically scattered from a graphite cylinder and emerged in a state of known polarization. The polarized beam was then scattered from a liquid oxygen target placed at an angle of 130° with respect to the graphite scatterer. The measured polarizations were analyzed by using a general, multilevel R-matrix reaction theory. A self-consistent set of resonance parameters was derived which was then used to predict the neutron differential and total cross sections from 0 to 4 MeV. These predictions are found to be in good agreement with published work. However, a comparison between the present results and recent theoretical calculations indicates the need for improvements in both the nuclear structure and nuclear reaction aspects of the theory. (Diss. Abstr. Int., B)

12795 PHF CALCULATION IN INTERMEDIATE COUPLING FOR LIGHT NUCLEI. Bouten, M.; Bouten, M. C. (SCK/CEN, Mol, Belg.). Czech. J. Phys.; 24: No. 11, 1277-1280(1974).

A method is described for carrying out shell-model calculations which take both the intermediate coupling and the deformation of the shell-model potential into account. Some results are given for ^{10}B. Remaining difficulties are discussed. (auth)

12796 INVESTIGATION OF THE REACTION $^{9}Be(d, p_0)^{10}Be$ IN THE DEUTERON ENERGY RANGE OF 0.9 TO 2.5 MeV. Bondouk, I. I.; Asfour, F.; Machali, F. (Atomic Energy Establishment, Cairo (Egypt). Nuclear Physics Dept.). Atomkernenergie; 24: No. 1, 62-64(1974).

5 figs.; 2 tabs.; 11 refs.

The reaction $^{9}Be(d, p_0)^{10}Be$ has been investigated in the deuteron energy range 0.9 to 2.5 MeV. Excitation functions were measured at two laboratory angles 45° and 120° and showed no sharp resonances. Angular distributions were measured in 200 keV intervals. An analysis of the data has been made using the Butler and the distored wave theories. (auth)

12797 DISPERSION CORRECTIONS TO ELASTIC ELECTRON SCATTERING BY ^{12}C AND ^{16}O. II. ON THE USE OF THE CLOSURE APPROXIMATION. Friar, J.L. (Department of Physics, Brown University, Providence, Rhode Island 02912); Rosen, M. Ann. Phys. (N.Y.) 87: No. 2, 289-326 (Oct 1974).

Within the framework of the closure approximation dispersion corrections to elastic scattering from ^{12}C and ^{16}O have been calculated using the Harmonic Oscillator Shell Model and keeping only the Coulomb contributions to the dispersive part of the second–Born amplitude. Center–of–mass effects and recoil have been taken into account. By means of an expansion scheme, the first–order corrections to the closure approximation have also been calculated and under certain conditions, it is believed that the corrected expansion is a valid one. It is found that the effective excitation energy, defined by the expansion, is approximately one oscillator spacing. The relation between this calculation and a previous one by deForest is discussed. (auth)

12798 ISOSPIN–CONSERVATION VIOLATION IN TWO–NUCLEON TRANSFER REACTIONS. Strobel, G.L. (The University of Georgia, Athens, Georgia 30602). Phys. Rev. Lett. 33: No. 23, 1392-1396 (2 Dec 1974).

The analog (p,^{3}He) and (p,t) reactions on ^{16}O have been studied by a second–order distorted–wave Born–approximation (DWBA) theory. Nucleon transfer is assumed to occur here only one nucleon at a time. The contribution of the isospin–1 intermediate–state projectile was made small at forward angles by increasing the imaginary part of the corresponding optical potential. This increase can be associated with the preferential decay of an isospin–1 projectile. Convergence of the DWBA is studied by comparing one– and two–step calculations. (auth)

12799 UNEXPECTED, INTERMEDIATE STRUCTURE AT HIGH LEVEL DENSITIES IN ^{24}Mg. Marquardt, N.; Volders, R.; Cardinal, C.; L'Ecuyer, J. (Laboratorie de Physique Nucléaire, Université de Montréal, Montréal, Canada). Phys. Rev. Lett. 33: No. 23, 1389-1392 (2 Dec 1974).

Excitation functions of the reaction $^{10}B(^{14}N,\alpha)^{20}Ne$ near the Coulomb barrier reveal clearly correlated cross–section structure in different α–particle channels. This indicates intermediate structure which had never been observed in the interaction of two non–identical, odd–odd nuclei at such high level densities. (auth)

12800 CONTINUUM RANDOM–PHASE–APPROXIMATION CALCULATIONS OF HIGHER MULTIPOLE GIANT RESONANCES IN ^{16}O AND ^{40}Ca. Krewald, S. (Institut für Kernphysik der Kernforschungsanlage Jülich, D–517 Jülich, Germany); Birkholz, J.; Faessler, A.; Speth, J. Phys. Rev. Lett. 33: No. 23, 1386-1388 (2 Dec 1974).

The positions and widths of E0, E1, E2, E3, and E4 giant resonances are calculated with a density–dependent force. (auth)

12801 CONTINUUM $3/2^+$ DOORWAYS AND THE ^{15}N GIANT DIPOLE RESONANCE. Divadeenam, M. (Duke University and Triangle University Nuclear Laboratory, Durham, North Carolina 27706); Weller, H.R. Phys. Rev. Lett. 33: No. 22, 1359-1361 (25 Nov 1974).

We attempt a two–particle, one–hole intermediate–structure interpretation of the ^{15}N giant dipole resonance located at 19.5–MeV excitation. A calculated doorway state at 19.1 MeV with a proton elastic escape width of 780 keV is associated with the observed $3+/2$ resonance (Γ_p=1000keV) in the giant–dipole–resonance region. The (p,γ_0) resonance cross section calculated for this state is in good agreement with experiment. (auth)

12802 GIANT M1 LEVELS IN NUCLEI. Hanna, S. S. (Stanford Univ., CA). Nukleonika; 19: No. 7-8, 655-680(1974).

A discussion is given of the giant M1 levels in nuclei of both $T_>$ and $T_<$ isospin, with particular emphasis on their gamma transitions. Selection rules, sum rules, isospin mixing, beta decay, and the nature of the levels are discussed. (26 figures, 5 tables) (auth)

12803 NUCLEAR REACTION STUDIES AND NUCLEAR SPECTROSCOPY ON LIGHTER NUCLEI. Fick, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Nukleonika; 19: No. 7-8, 693-716(1974).

The application of two experimental techniques which became available in recent years to nuclear spectroscopy is described. The investigation of 1p nuclei with (d,p) reactions is used as an example for the application of polarized-deuteron beams; and the elastic transfer on (s,d) nuclei, for the application of heavy-ion beams. (19 figures) (auth)

12804 INDIVIDUAL-PARTICLE MODEL, AND APPLICATION TO THE 1p AND (2s,1d) SHELLS. Hock, G. ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 3, 207-241(1974). (In Hungarian).

The individual-particle shell model with intermediate coupling in LS coupling was surveyed giving an applicable tool and a large scale of references to it for usual shell model calculations on light nuclei characterized by equivalent particles. One way is shown for doing it in 1p shell nuclei. The configuration mixing and its application to the (2s,1d) nuclei ^{19}F and ^{19}O are summarized on the basis of Elliott and Flowers's work. (auth)

12805 EXPERIMENTAL INVESTIGATION OF THE REACTIONS $^{9}Be(d,P_0)^{10}Be$, $^{9}Be(d,p_1)^{10}Be$ AND $^{9}Be(d,t_0)^{8}Be$ IN THE DEUTERON ENERGY RANGE 0.9 TO 2.5 MeV. Bondouk, I.; Asfour, F.; Machali, F. (Atomic Energy Establishment, Cairo). Rev. Roum. Phys.; 19: No. 5, 551-553(1974).

The excitation functions and angular distributions were measured for the reactions $^{9}Be(d,p_0)^{10}Be$, $^{9}Be(d,p_1)^{10}Be^*$, and $^{9}Be(d,t_0)^{8}Be$ at 0.9 to 2.5 MeV. (JFP)

12806 NEUTRON TOTAL CROSS SECTIONS ON NUCLEI FROM 30 TO 270 GeV/c. Jones, L.W.; Ayre, C.A.; Gustafson, H.R.; Longo, M. J.; Romana Murthy, P. V. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48104). Phys. Rev. Lett. 33: No. 24, 1440-1443 (9 Dec 1974).

We present results of measurements of the total cross section for neutrons on a variety of nuclei in the momentum range 30 to 270 GeV/c. The measurements were made with the standard transmission technique and have a typical accuracy ~1%. The cross sections are compared with theoretical predictions. It is found that a correction for inelastic screening in the nucleus is required. The cross sections are found to vary as $A^{0.77}$ over the entire energy range. (auth)

12807 MACROSCOPIC AND MICROSCOPIC MODEL ANALYSIS OF POLARIZED PROTONS SCATTERING ON ^{18}O. Escudié, J.L.; Lombard, R.; Pignanelli, M.; Resmini, F.; Tarrats, A. (DPh–N/ME, CEN Saclay, BP 2, 91190 Gif–sur–Yvette, France). Phys. Rev. C 10: No. 5, 1645-1662 (Nov 1974).

Differential cross sections and analyzing powers for polarized (p, p') scattering on ^{18}O have been measured at an incident proton energy of 24.5 MeV, using the Saclay AVF cyclotron. Data have been taken for nine levels, up to 7.11 MeV excitation energy. The analysis has been

carried out in the distorted wave Born approximation within the framework of the macroscopic and microscopic models. For the latter the available wave functions of ^{18}O and an approximate description of the nucleon–nucleon interaction, derived from the Hamada–Johnston potential, have been used. The macroscopic model, with just a simple deformation parameter β, accounts reasonably well for some even–parity transitions, and also for the excitation of the 3^- level at 5.09 MeV. Furthermore, coupled–channel calculations support evidence for a rotational band based on the ground state and including the 2^+ at 1.98 MeV and the 4^+ at 7.11 MeV. The analysis also supports a collective character of the 3^- level at 5.09 MeV and accounts for the observed strong excitation of this state. Satisfactory fits are obtained for some levels within the microscopic model, even though the absolute values of the cross sections are usually underestimated and large normalization factors needed. The use of an imaginary form factor adds some structure to the calculated angular distributions and improves the agreement between theory and experiment for those transitions for which the real form factor is collectivelike, i.e., peaked at the nuclear surface. (auth)

12808 GAMMA RAYS EMITTED FOLLOWING THE INTERACTION OF 230–MeV NEGATIVE PIONS WITH ^{16}O. Lieb, B.J. (George Mason University, Fairfax, Virginia 22030); Funsten, H.O. Phys. Rev. C 10: No. 5, 1753-1761 (Nov 1974).

γ rays have been detected from 230–MeV negative pions incident on a water target. Deexcitation γ rays from ^{10}B, ^{12}C, ^{13}C, ^{14}C, ^{14}N, ^{15}N, ^{15}O, ^{16}O, and ^{16}N have been identified, and cross sections for excitation of particular residual states, determined. Where necessary, the cross sections have been corrected for γ feeding from higher states. Decays from short-lived nuclear states result in Doppler-broadened peaks which yield nuclear recoil momenta. (auth)

12809 ELASTIC SCATTERING OF LIGHT PARTICLES BY CARBON, OXYGEN, AND NITROGEN. Jarmie, N.; Jett, J.H.; Semper, R.J. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. C 10: No. 5, 1748-1752 (Nov 1974).

153 cross section data are presented for targets of carbon, oxygen, and nitrogen bombarded by protons, deuterons, and tritons in the 10 to 20 MeV region. The errors range from 1 to 2%. Comparisons are made with existing measurements, where available. (auth)

12810 LEVELS OF ^{13}C FROM A STUDY OF $^{9}Be(^{7}Li, p)^{13}C$. Garrett, J.D. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174 and Brookhaven National Laboratory, Upton, New York 11973); Ajzenberg–Selove, F.; Bingham, H.G. Phys. Rev. C 10: No. 5, 1730-1738 (Nov 1974).

The $^{9}Be(^{7}Li, p)^{13}C$ reaction has been studied at $E(^{7}Li) = 20$ MeV using the Penn multiangle spectrograph. In addition to $^{13}C^*$ (0.0, 0.74), proton groups are observed to at least 25 excited states with $E_x < 12$ MeV. Angular distributions are reported for many of these groups. $J^\pi = (1/2^-)$ and $(5/2^-)$ are suggested for the states $^{13}C^*$ (3.11) and $^{13}C^*$ (4.22), respectively. It is concluded from the small reduced width for neutron decay of suggested 2p–1h neutron states in ^{13}C that the ^{14}C(g.s.) has only a small 2p–2h neutron component. (auth)

12811 LIGHT PARTICLE AND GAMMA–RAY PRODUCTION IN $^{12}C + ^{14}N$ INTERACTIONS. Olmer, C.; Stokstad, R.G.; Hanson, D.L.; Erb, K.A.; Sachs, M.W.; Bromley, D.A. (A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06520). Phys. Rev. C 10: No. 5, 1722-1729 (Nov 1974).

Angular distributions were measured for particle groups populating low–lying levels in the reactions $^{12}C(^{14}N, d)^{24}Mg$, $^{12}C(^{14}N, p)^{25}Mg$, and $^{12}C(^{14}N, \alpha)^{22}Na$ at $E_{lab} = 20$ and 25 MeV. Excitation functions were also measured for low-lying γ-ray transitions in ^{24}Mg, ^{25}Mg, ^{24}Na, ^{21}Ne, ^{21}Na, and ^{18}F produced by ^{12}C bombardment of ^{14}N at $E_{lab} = 14–33$ MeV. The excellent agreement of Hauser–Feshbach statistical-model predictions with these results indicates that the light-particle production from the $^{12}C + ^{14}N$ interaction reflects a dominant compound nuclear interaction mechanism. (auth)

12812 HALF–LIVES OF ^{6}He, ^{19}Ne, AND $^{42}Sc^m$. Wilkinson, D.H. (Brookhaven National Laboratory, Upton, New York 11973 and Nuclear Physics Laboratory, Oxford, England); Alburger, D.E. Phys. Rev. C 10: No. 5, 1993-1995 (Nov 1974).

The half–lives of ^{6}He, ^{19}Ne, and $^{42}Sc^m$ have been measured as 808.1 ± 2.0 msec, 17.36 ± 0.06 sec, and 62.0 ± 0.3 sec, respectively. The activities were formed in the $^{9}Be(n,\alpha)^{6}He$, $^{19}F(p,n)^{19}Ne$, and $^{42}Ca(p,n)^{42}Sc$ reactions. Half–lives of ^{6}He and ^{19}Ne were determined by multiscaling β rays detected in a plastic scintillator, whereas the $^{42}Sc^m$ half–life was obtained from the decay of the γ–ray spectrum in a Ge(Li) detector. The ft values deduced for ^{6}He, ^{19}Ne, and $^{42}Sc^m$ are, respectively, 815.7 ± 4.2 sec, 1728.4 ± 6.7 sec, and 14758 ± 91 sec. The values $|\langle\sigma\rangle|$ of the Gamow–Teller matrix elements are given by, respectively, $R_\tau\,|\langle\sigma\rangle| = 2.7472 \pm 0.0077$, 1.6006 ± 0.0042, and 0.6448 ± 0.0021, where R_τ is the magnitude of the ratio of the axial to vector coupling constants appropriate for the respective complex nuclei. (auth)

12813 WAVE FUNCTIONS AND PARTICLE TRANSFER FORM FACTORS OF ^{42}Ca AND ^{18}O. Bang, J. (Niels Bohr Institutet, Copenhagen (Denmark)); Gareev, F. A. (Joint Inst. for Nuclear Research, Dubna (USSR)). Nucl. Phys., A; 232: No. 1, 45-57(28 Oct 1974).

Wave functions and energies of 0^+ states of ^{42}Ca and ^{18}O are calculated using an expansion in Sturm–Liouville functions. The method is an alternative to the inclusion of continuum wave functions in shell model calculations and represents a considerable simplification compared to this. The wave functions are used to calculate cross sections of two-particle transfer. (auth)

12814 ELECTRON SCATTERING AND α–CLUSTER DESCRIPTION OF ^{12}C AND ^{20}Ne. Abgrall, Y.; Gabinski, P.; Labarsouque, J. (Bordeaux-1 Univ., 33—Talence (France). Lab. de Physique Theorique). Nucl. Phys., A; 232: No. 1, 235-248(28 Oct 1974).

The elastic and inelastic electron scattering form factors in the ground-state band of ^{12}C and ^{20}Ne were calculated using the Brink α–cluster model projected wave functions. From a systematic comparison with experiment it is concluded that usual central forces like the Brink–Boeker B1 force give an unrealistically large clustering while that obtained using density dependent interactions like the Skyrme S1 force is too low. For intermediate values of the clustering it is possible in ^{12}C to reproduce simultaneously the elastic as well as the inelastic form factors to the 2_1^+ (4.44 MeV), 3_1^- (9.64 MeV) and 4_1^+ (14.08 MeV) states for not too large transfers. Noticeable discrepancies between calculated and experimental 2_1^+ and 3_1^- inelastic form factors at transfers higher than 1.5 fm^{-1} reveal inherent weaknesses of the α–cluster wave functions which are not corrected after inclusion of the θ-vibrations. (auth)

12815 INELASTIC SCATTERING OF 82 MeV DEUTERONS ON ^{16}O. Duhamel, G.; Langevin-Joliot, H.; Didelez, J. P.; Gerlic, E.; van de Wiele, J. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire). Nucl. Phys., A; 231: No. 2, 349-363(14 Oct 1974).

The inelastic scattering of 81.6 MeV deuterons was studied on sixteen levels up to 13.8 MeV excitation energy in ^{16}O. The experimental angular distributions were compared with DWBA predictions within the framework of the collective model. The addition of an imaginary term is found to be necessary to account for the angular distribution shape of the collective transitions at small angles. Deformation parameters were extracted for the collective states. (auth)

12816 RESONANCE EFFECTS IN THE $^{12}C(p(pol),p')^{12}C^*,1^+$ TRANSITION. Amos, K. A.; Geramb, H. V.; Sprickmann, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik); Arvieux, J.; Buenerd, M.; Perrin, G. (Grenoble–1 Univ., 38 (France). Inst. des Sciences Nucleaires). Phys. Lett., B; 52: No. 2, 138-142(30 Sep 1974).

Differential cross sections and analyzing powers from inelastic scattering of 22.3, 26.7 and 30.5 MeV polarized protons exciting the 1^+, T = 0 state in ^{12}C (12.71 MeV) were measured. The rapid energy variation of the data is explained by virtual excitation of giant resonances in ^{12}C. The analyses were made using an antisymmetrized DWA in which both one and two step processes were included. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 12239, 12792, 12799, 12802, 12803, 12806, 12814, 12840, 12853, 12878, 12879, 12896, and 13013.

12817 (AERE-PR/NP-21, pp 28-29) FORWARD ANGLE CROSS-SECTIONS IN THE $^{27}Al(^{16}O,^{15}N)^{28}Si$ REACTION. Hooton, B. W. (Atomic Energy Research Establishment, Harwell, Eng.); Ivanovich, M.; Phillips, W. R. Aug 1974.

12818 (AERE-PR/NP-21, pp 33-37) $0^+ \rightarrow 0^+$ SUPERALLOYED β-DECAYS AND THEIR RELATION TO WEAK INTERACTION THEORY. Freeman, J. M. (Birmingham Univ., Eng.); Petty, R. J.; Burcham, W. E.; Squier, G. T.; Hoath, S. D. Aug 1974.

12819 (ANU-P-595) ELECTROMAGNETIC TRANSITIONS IN ^{22}Na. Spear, R. H.; Bell, R. A. I.; Esat, M. T.; Gardner, P. R.; Kean, D. C.; Baxter, A. M. (Australian National Univ., Canberra). Oct 1974. 43p. Dep. NTIS (U. S. Sales Only) $5.25.

Electromagnetic properties of excited states of ^{22}Na below 4.6–MeV excitation energy have been studied using the $^{23}Na(^{3}He, \alpha\gamma)^{22}Na$ and $^{19}F(\alpha,n\gamma)^{22}Na$ reactions. Investigation of the decay scheme of the 4069-keV level using the $^{23}Na(^{3}He,\alpha\gamma)^{22}Na$ reaction shows a (10 ± 3)% branch to the 1528-keV level, compared to a

value of 21% reported previously. The existence of weak gamma-ray transitions from the 1983-, 2211-, and 2572-keV levels has been confirmed from gamma-ray spectra obtained above and below threshold for population of these levels via the $^{19}F(\alpha,n)^{22}Na$ reaction. A long-standing controversy regarding the spin of the 1983-keV level has been resolved by gamma-ray angular distribution measurements close to threshold for the population of the 1983-keV level via the $^{19}F(\alpha,n)^{22}Na$ reaction; the results show that $J^{\pi}(1983) = 3^+$. Neutron–gamma correlation studies of the $^{19}F(\alpha, n\gamma)^{22}Na$ reaction, taken in conjunction with previous data, impose limitations on spins and parities of several levels and on mixing ratios of associated gamma-ray transitions. The spin–parity values are as follows, relatively unlikely assignments being bracketed: $J^{\pi}(3708) = 6^+(4^+)$; $J^{\pi}(4069) = 4^+$; $J^{\pi}(4466) = 1^-, 2^+, 3^-$ or 4^-; $J^{\pi}(4522) = 7^+, 5^+(4^-,6^+)$. (auth)

12820 (CONF-741131-2) SHELL MODEL CALCULATIONS OF ELECTROMAGNETIC OBSERVABLES OF NUCLEI IN THE SD-SHELL REGION. McGrory, J. B. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 30p. Dep. NTIS $4.50.

From international conference on gamma-ray transition probabilities; Delhi, India (11 Nov 1974).

The review of the application of the shell model to electromagnetic decay processes is reviewed for light nuclei. An outline of the shell model calculation, various effective operators which enter into the calculations of electromagnetic properties, existing calculations of such properties, and the sensitivity of these calculations to the ingredients of the shell model calculations are considered. (JFP)

12821 (COO-2186-8, pp 12-22) ALPHA CAPTURE REACTIONS. Okon, O. B.; Bakhru, H.; Cue, N.; Sen, P. (State Univ. of New York, Albany). Jun 1973.

In Nuclear Accelerator Laboratory annual report.

12822 ROTATIONAL STATES IN ^{26}Mg. Nagel, A.; Jones, G. D.; Lornie, P. R. G.; Nixon, M. R.; Price, H. G.; Twin, P. J. (Univ. of Liverpool). J. Phys., A (London); 7: No. 14, 1697-1704(21 Sep 1974).

The decay properties of the levels at 3.941 (3^+), 5.476 (4^+) and 5.716 MeV (4^+) in ^{26}Mg have been investigated. Particle γ-ray angular correlations were measured following the reactions $^{26}Mg(\alpha,\alpha'\gamma)^{26}Mg$ and $^{26}Mg(p,p'\gamma)^{26}Mg$, enabling accurate branching ratios and E2/M1 mixing ratios to be determined. The lifetimes were obtained with the reaction $^{23}Na(\alpha,p\gamma)^{26}Mg$ by using the Doppler shift attenuation method. The transition from the 5.476 (4^+) to the 3.941 MeV (3^+) state is shown to have an E2 strength of 12^{+3}_{-4} Weisskopf units whilst the transitions from the 3.941 MeV state itself are essentially dipole. The data together with the revised branching ratios result in a new assignment of states to the $K^{\pi} = 2^+$ and 3^+ rotational bands. (auth)

12823 RESEARCH REPORT OF LABORATORY OF NUCLEAR SCIENCES, TOHOKU UNIV. Torizuka, Y.; Kojima, Y.; Saito, T.; Ito, K.; Nakata, A. (Tohoku Univ., Sendai). Kakuriken Kenkyu Hokoku; 6: No. 1, 1-164(Jun 1973). (In Japanese).

In the study on nuclei by electron scattering, measurements on ^{44}Ca, ^{56}Fe, and ^{152}Sm were carried out. Experiments on electron scattering were conducted for the range of the giant resonance of ^{26}Mg and ^{27}Al. In the study on isobaric analog states by the (e, e'p) reaction, transformed nuclei of ^{181}Ta, ^{209}Bi, and ^{142}Nd and light nuclei of ^{48}Ca, ^{44}Ca, and ^{45}Sc were taken up. The total cross section of ^{238}U for fast neutrons was measured. Measurement of delayed neutron spectra accompanying photofission of ^{238}U was performed. Low-lying state of $^{152}_{64}Gd_{91}$ was examined by $\gamma-\gamma$ angular correlations. Neutron diffraction was carried out to examine the crystalline structure of Ti Ni compound. Position of C atoms in γ phase was determined by neutron diffraction in Fe–Mn–C alloy. Molecular size of D_2O and CS_2 in liquid state was derived as the application of high momentum transfer structure factors. ZrO_2-type crystalline structure was analyzed by the TOF method with single crystal specimens. Diminishing effect in case of TOF method was examined by the measurement on single crystals of Al and KBr. Magnetic interaction was determined by the neutron paramagnetic scattering of $MnTiO_3$ and $MnGeO_3$. Neutron scattering experiments were performed on a CS_2 solution of polystyrene. The TOF filter method was confirmed to be suitable for the study on high-energy inelastic scattering. The electronic state of FeSb was determined by neutron diffraction. The presence of isotopic effects was examined for $H^{80m}Br-CH_4$ and $H^{82m}Br-CH_4$ systems. Photon activation analysis was tested for the survey of trace elements in NBS biological matrix standard reference material, orchard leaves. The state of operation of data processing equipment is reported. (JA)

12824 SPECTROSCOPY OF EXOTIC NUCLEI USING HEAVY–ION TRANSFER REACTIONS. Scott, D.K.; Harvey, B.G.; Hendrie, D.L.; Kraus, L.; Maguire, C.F.; Mahoney, J.; Terrien, Y.; Yagi, K. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 33: No. 22, 1343-1346 (25 Nov 1974).

The (^{11}B, ^{8}B), (^{11}B, ^{11}C), and (^{11}B, ^{13}N) reactions were studied at 86 MeV as a technique for the mass measurement and spectroscopy of exotic nuclei. (auth)

12825 SURVEY OF E2 STRENGTH OBSERVED IN CAPTURE REACTIONS. Hanna, S. S. (Stanford Univ., CA). Nukleonika; 19: No. 7-8, 681-685(1974).

In this survey of E2 strength observed in (α,γ) and $(p,\gamma) + (\vec{p},\gamma)$ reactions, the E2 strength is observed to be spread out over large regions extending from well below to well above the GDR. The observed E2 strength in (γ, α_0) and (γ, p_0) is of the order of 1% of the E2 sum rule per MeV interval, and is roughly independent of the nuclear species. (3 figures) (auth)

12826 CASE OF THE RELUCTANT RESONANCES. Kalbach, C. (CEN de Saclay, Gif-sur-Yvette, France). Nukleonika; 19: No. 7-8, 733-739(1974).

Resonances corresponding to states in ^{24}Mg at around 20 MeV of excitation were first observed in the $^{12}C + ^{12}C$ system in 1960. Since then, many studies of these and similar resonances have been carried out and have investigated different reaction exit channels; however, a completely satisfactory explanation for the resonances has not yet been found. Recent experiments at Saclay in which the $^{23}Na + p$ and $^{20}Ne + \alpha$ entrance channels were studied provide new evidence supporting an explanation of these resonances as alpha-cluster states. (5 figures, 2 tables) (auth)

12827 ^{37}Cl NUCLEUS BY PROTON SCATTERING. Avrigeanu, V.; Bucurescu, D.; Dragulescu, E.; Ivascu, M.; Popescu, D. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 5, 561-563(1974).

Preliminary results are reported for the chlorine-37 levels from the $^{37}Cl(p,p')$ reaction at 15.0 MeV. Angular distributions for the strongest peaks were obtained. (JFP)

12828 RECOIL PROPERTIES OF ^{22}Na AND ^{24}Na PRODUCED IN THE INTERACTION OF ^{27}Al WITH 3– TO 300–GeV PROTONS. Steinberg, E.P. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439); Winsberg, L. Phys. Rev. C 10: No. 5, 1925-1927 (Nov 1974).

Values of 2W(F + B) and F/B were determined for ^{22}Na and ^{24}Na in irradiations of Al targets with protons of 3, 6, 9, 11.5, 200, and 300 GeV. The values of 2W(F + B) were found to be constant within experimental error from 3 to 300 GeV for both ^{22}Na and ^{24}Na. The F/B values for both nuclides decreased about 20% over the same energy range. (auth)

12829 SPECTROSCOPY OF ^{29}P VIA THE $^{28}Si(p,p\gamma)$ REACTION. Gearhart, N.L.; Hausman, H.J.; Morgan, J.F.; Norton, G.A.; Tsoupas, N. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. C 10: No. 5, 1739-1747 (Nov 1974).

Excitation functions have been measured for inelastic proton scattering from the 1.78-MeV, 2^+ first excited state of ^{28}Si between 3.1 and 5.7 MeV. Two previously unidentified resonances corresponding to states in ^{29}P with excitation energies of 6.577 and 7.272 MeV have been observed. Triple angular correlations in the Goldfarb–Seyler geometry have been measured as a function of energy over all the resonances observed in the inelastic excitation function. Information obtained from the angular correlation data has been combined with previous information concerning these states to allow J^{π} assignments for 9 of the 11 states observed. (auth)

12830 IDENTIFICATION AND LIFETIME DETERMINATION OF THE 6^+ MEMBER OF THE GROUND–STATE ROTATIONAL BAND IN ^{22}Ne. Fifield, L.K.; Zurmühle, R.W.; Balamuth, D.P. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 10: No. 5, 1785-1791 (Nov 1974).

The $^{19}F(\alpha,p\gamma)^{22}Ne$ reaction was used to measure $p-\gamma$ angular correlations for the 6.31 and 6.34 MeV states in ^{22}Ne. The mean lifetimes of the two levels were determined to be 78 ± 15 fs (6.31 MeV) and 24^{+15}_{-17} fs (6.34 MeV) using the same reaction and the Doppler–shift attenuation method. Unambiguous spin and parity assignments of 6^+ and 4^+ were obtained for the 6.31 and 6.34 MeV states, respectively. An earlier identification of the 6.34 MeV state as the 6^+ member of the ground-state rotational band is therefore incorrect. The B(E2) value of the 6.31 MeV (6^+) → 3.36 MeV (4^+) transition is in good agreement with recent large–basis shell model calculations, and the 6.31 MeV state may be identified as the 6^+ member of the ground-state rotational band of ^{22}Ne. (auth)

12831 E0 DECAY OF THE FIRST EXCITED 0^+ STATES IN ^{26}Mg AND ^{30}Si. Adloff, J.C.; Souw, K.H.; Disdier, D.; Scheibling, F.; Chevallier, P. (Centre de Recherches Nucléaires, Université Louis

Pasteur, Strasbourg, France); Wolfson, Y. Phys. Rev. C 10: No. 5, 1819-1828 (Nov 1974).

A new method was used to measure E0 π−decay branching ratios. A plastic scintillator pair spectrometer of high efficiency (3%) was used. It consists of four detectors. Two of them, very thin, select the electrons; the other two, thick, help to measure their energies. An annular counter (Ω = 0.10 sr), working in coincidence with the spectrometer, allows the selection of the π decay relevant to the 0^+ excited state and the determination of its population yield. The reactions ^{23}Na(α,p)^{26}Mg(3.58 MeV)(π) and ^{27}Al(α,p)^{30}Si(3.79 MeV)(π) have been used to study the E0 π decay of the first excited 0^+ state in ^{26}Mg and ^{30}Si. Pair spectra from the spectrometer were recorded in coincidence with protons in two−dimensional arrays. From the coincidence spectra the values for Γ_π/Γ are found to be (5.1 ± 0.7) × 10^{-3} and (2.6 ± 0.6) × 10^{-3}, respectively, for ^{26}Mg(3.58 MeV) and ^{30}Si(3.79 MeV). When combined with the available lifetimes of these states, these ratios yield $\langle M\rangle_\pi$ = (3.0 ± 0.25) fm^2 (^{26}Mg) and (1.4 ± 0.2) fm^2 (^{30}Si) for the monopole matrix elements. (auth)

12832 COUPLED−CHANNEL BORN APPROXIMATION AND l = 2 j DEPENDENCE IN ^{28}Si(d,p)^{29}Si FROM 10 TO 18 MeV. Coker, W.R.; Udagawa, T.; Hoffmann, G.W. (Center for Nuclear Studies, University of Texas, Austin, Texas 78712). Phys. Rev. C 10: No. 5, 1792-1797 (Nov 1974).

We discuss the general problem of j dependence in nuclear reactions, and evidence that l = 2 j dependence seen in (d,p) reactions is, at least in many cases, connected with the collective character of the target and residual nuclei in the reaction. To test this idea, we present analyses of three sets of data for ^{28}Si(d,p)^{29}Si, at 10, 13, and 18 MeV incident deuteron energy. These analyses are performed in terms of the coupled-channel Born approximation (CCBA), and include inelastic excitations of vibrational character both in entrance and exit channels. It is shown that the observed l = 2 j dependence, particularly for the 1.28-MeV $3/2^+$ and 2.03-MeV $5/2^+$ states in ^{29}Si, can be well explained by CCBA. Evidence is also presented that the 2.03-MeV $5/2^+$ and 2.43-MeV $3/2^+$ states have to a large extent the character [^{28}Si(2^+_1) × $(s_{1/2})_n$]. (auth)

12833 ^{18}O(^{3}He, p)^{20}F REACTION AND (sd)^4 STATES IN ^{20}F. Crozier, D.J.; Fortune, H.T. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 10: No. 5, 1697-1707 (Nov 1974).

The ^{18}O(^{3}He, p)^{20}F reaction has been studied at a ^{3}He bombarding energy of 18 MeV. The resulting angular distributions for states of probable (sd)^4 configuration have been examined by the techniques of distorted−wave analysis, utilizing two−particle coefficients of fractional parentage obtained from recent shell−model calculations. Satisfactory agreement is found between theory and the present experiment. (auth)

12834 FRACTIONATED SINGLE−PARTICLE STATES OF ^{31}Si AT E_n = 5.3−9.4 MeV. Hoffmann, G.W.; McIntyre, J.; Coker, W.R. (Center for Nuclear Studies, University of Texas, Austin, Texas 78712). Phys. Rev. C 10: No. 5, 1671-1677 (Nov 1974).

A total of 40 states of ^{31}Si in the region of excitation from about 5 to 9 MeV have been studied using the reaction ^{30}Si(d, p) at 10 MeV incident deuteron energy, and a biased quadrupole spectrometer. Fractionated single−particle states are identified via their forward−angle cross sections, using distorted−wave Born−approximation predictions with bound and resonance state form factors for the residual ^{31}Si system. Results are contrasted with what is known of the lower lying states, from large−basis shell−model calculations and earlier (d, p) experiments. (auth)

12835 TWO-STEP MECHANISM IN THE ^{22}Ne(p,t) REACTION. Vourvopoulos, G.; Greenfield, M. B. (Florida A and M University, Tallahassee, Florida, USA); Ball, J. B.; Raman, S.; Dagenhart, W. K. (Oak Ridge National Lab., Tenn. (USA)). Phys. Lett., B; 52: No. 2, 187-188(30 Sep 1974).

The forward-angle differential cross sections were measured for the ^{22}Ne(p,t) reaction leading to the 4.97 MeV, 2^- state in ^{20}Ne. Comparison of the data with the results of calculations shows that the two-step mechanism responsible for exciting this state is (p−p′−t) rather than (p−d−t). (auth)

12836 STUDY OF STRUCTURE IN THE ^{28}Si(p,n)^{28}P AND ^{28}Si(p,α)^{25}Al EXCITATION FUNCTIONS. Gunn, G. D.; Kemper, K. W.; Fox, J. D. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Nucl. Phys., A; 232: No. 1, 176-188(28 Oct 1974).

The ^{28}Si(p,n)^{28}P and ^{28}Si(p,α)^{25}Al reactions were studied over the energy range of 16.0 to 18.2 MeV incident proton energy. Fluctuations appear in the excitation functions over the entire range with widths of 100 and 48 keV for the neutron and alpha channels, respectively. The energy averaged ^{28}Si(p,α)^{25}Al angular distributions are not reproduced by Hauser-Feshbach compound nucleus calculations but do resemble DWBA calculations. Because of the complex nature of the reaction mechanism in this energy range, it could not be concluded whether the structure in the excitation functions is due to doorway states or Ericson fluctuations. (auth)

12837 THE MAGNITUDE OF (d,p) CROSS SECTIONS FROM COMPOUND NUCLEUS REACTIONS FOR 2s-1d SHELL NUCLEI. Brown, G.; Haigh, J. G. B.; Watson, D. L. (Bradford Univ. (UK)). Nucl. Phys., A; 232: No. 1, 125-138(28 Oct 1974).

Examination of published data for (d,p) reactions with ^{24,25,26}Mg and ^{28,30}Si target nuclei at energies in the region of E_d = 10 MeV shows that the angular distributions cannot be reproduced by DWBA calculations. This is confirmed by a new measurement of cross sections for the ^{24}Mg(d,p)^{25}Mg reaction at E_d = 10 MeV. The discrepancy between the (d,p) cross sections and the DWBA calculations changes with incident energy and target nucleus in a manner which indicates the presence of compound nucleus reactions. When cross sections calculated from a Hauser-Feshbach model are added to those obtained from DWBA calculations it is shown that satisfactory fits are obtained to practically all the angular distributions for Mg and Si(d,p) reactions at E_d < 13.5 MeV. On the basis of the Hauser-Feshbach calculations, the compound nucleus contribution may affect the determination of spectroscopic factors for most levels, including strongly excited ones. Moreover the Hauser-Feshbach calculations alone reproduce the cross sections of levels of spin $7/2^+$ and $9/2^+$ observed both in the strongly deformed ^{25}Mg nucleus and in other more weakly deformed Mg and Si isotopes. Thus the strength of many levels can be accounted for without invoking theories of two-step processes for strongly deformed nuclei. (auth)

12838 A USEFUL SPECTROSCOPIC TOOL: THE (^{7}Li, ^{6}He) REACTION. Kemper, K. W.; White, R. L.; Charlton, L. A.; Gunn, G. D.; Moore, G. E. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Phys. Lett., B; 52: No. 2, 179-182 (30 Sep 1974).

Angular distribution measurements for the reactions ^{24}Mg(^{7}Li, ^{6}He)^{25}Al and ^{52}Cr(^{7}Li,^{6}He)^{53}Mn at E(^{7}Li) = 34 MeV show that for angles less than 15°, the shapes of the measured angular distributions allow $d_{\frac{5}{2}}$ or $d_{\frac{3}{2}}$, and $f_{\frac{7}{2}}$ or $f_{\frac{5}{2}}$ final-state configurations to be distinguished when compared with finite-range DWBA calculations. (auth)

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Refer also to abstracts 11387, 12785, 12800, 12803, 12806, 12812, 12813, 12818, 12838, 12878, 12879, 12881, 12888, 12896, 12902, 12924, 12981, 13009, and 13013.

12839 (BNL-19367) DELAYED γ RAYS IN THE REACTION ^{40}Ca + ^{16}O. Fintz, P.; Gallmann, A.; Guillaume, G.; Jones, K. W.; Jundt, F.; Ordonez, I. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 6p. Dep. NTIS $4.00.

The ^{40}Ca + ^{16}O reaction, obtained with a beam of 52-MeV $^{16}O^{6+}$ ions from the Strasbourg MP Tandem, on a thick target of natural calcium (97% ^{40}Ca) was used to measure delayed γ rays with a fast rabbit system and a 56-cc Ge(Li) γ-ray detector placed in a shielded counting area. After particle evaporation the isotopes primarily formed were ^{50}Mn, ^{52}Fe, and the isomeric states of ^{53}Fe and ^{54}Co. This preliminary study yielded information on γ-ray energy values, relative intensities, half-lives, and relative cross sections. The following half-lives were obtained: ^{50}Mn : 1.73 ± 0.15 min, ^{53m}Fe : 2.65 ± 0.06 min, ^{54m}Co : 1.49 ± 0.13 min. The E4 (3.04 → 2.34 MeV) and M5 (3.04 → 1.33 MeV) transition strengths in ^{53m}Fe were 0.26 and 0.23 Moszkowski units, respectively. (1 figure, 1 table) (auth)

12840 (CEA-R-4634) DIFFERENTIAL GAMMA-RAY PRODUCTION CROSS SECTIONS MEASURED IN Si(n, Xγ), Cr(n, Xγ), AND Ni(n, Xγ) REACTIONS FOR INCIDENT NEUTRONS BETWEEN 3 AND 7 MeV ENERGY, AND ALSO AT 14.1 MeV. Grenier, G.; Duchemin, B.; Parisot, D. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1974. 49p. (In French). Dep. NTIS (US Sales Only) $5.50.

Differential gamma-ray production cross sections measured in (n, Xγ) reactions for natural silicon, chromium, and nickel are presented. Cross sections were measured for incident neutrons between 3 and 7 MeV energy, and also at 14.1 MeV. Data were obtained for gamma-ray detection angles of 55° for 3 < E_n < 7 MeV and at 55° and 90° for E_n = 14.1 MeV. Gamma-ray spectra were accumulated by using a Ge(Li) diode as the central detector in an anti-Compton gamma-ray spectrometer. Time of flight was used with the spectrometer to discriminate against pulses due to neutrons striking the detector or materials near the detector, and also against those from time-uncorrelated background. An automatic gamma-ray spectral analysis was used.

The data were compared, where possible, with previously measured values. Theoretical calculations of the production cross sections for the strongest gamma rays of silicon, chromium, and nickel were made based on the statistical model. The Moldauer width fluctuation corrections were included in the calculations. The calculated cross sections are compared to measurements and to earlier calculations for incident neutron energies between 2 and 7 MeV. (15 figures, 11 tables) (auth)

12841 (COO-2186-8, pp 30-31) ^{57}Fe(p,n)^{57}Co REACTION. Rimawi, K.; Benenson, R. E. (State Univ. of New York, Albany). Jun 1973.

In Nuclear Accelerator Laboratory annual report.

12842 (INDC(CCP)-38/U, pp 36-60) EVALUATION OF DATA ON THE TOTAL CROSS SECTION OF IRON FOR FAST NEUTRONS. Filippov, V. V. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

An approach has been developed in which the structure of total neutron cross sections is studied by measuring the transmission functions. This work first studies the existing data on the total cross section of Fe in the unresolved-resonance region (above 0.5 MeV). After obtaining the most reliable average cross section curve possible, it then attempts, having compared the characteristics of the total cross section structure (as calculated from the best available detailed measurements) with the values obtained from transmission functions, to get the most reliable values for these characteristics. (14 figures, 5 tables) (RWR)

12843 (INDC(CCP)-42/U, pp 71-95) MUF: A PROGRAM FOR THE MULTILEVEL CALCULATION OF THE CROSS SECTIONS OF NON-FISSIONABLE NUCLEI FROM RESONANCE PARAMETERS. Abagyan, L. P.; Nikolaev, M. N.; Sinitsa, V. V. Aug 1974. Translated from Russian.

In nuclear constants, No. 9.

The MUF program, which enables one to calculate the energy dependence of the cross sections of nonfissionable nuclei with allowance for the effects of interresonance interference and interference between resonance and potential scattering, is described. There is provision for calculating mean-group cross sections, self-shielding coefficients, and transmission functions. As the MUF program does not make it possible to take into account the temperature of the medium, it can be used for calculating only the cross sections of light and intermediate nuclei. The physical basis of the program and examples of its use are given. The complete Algol text of the program is included. (5 figures, 5 tables) (RWR)

12844 (UCID-16136, p 5) PHOTONEUTRON CROSS SECTION OF ^{55}Mn AND ^{59}Co. Alvarez, R. A.; Berman, B. L.; Meyer, P. 10 Oct 1972.

In status report to USNDC.

12845 PROPERTIES OF STATES IN ^{41}Ca EXCITED IN THE ^{40}Ca(α, 2pn)^{41}Ca REACTION. Alenius, N. G.; Skeppstedt, O.; Wallander, E. (Univ. of Tech., Goteborg). Lett. Nuovo Cim.; 11: No. 14, 617-621(7 Dec 1974).

The properties of states in calcuim-41 excited in the ^{40}Ca(α, 2pn) ^{41}Ca reaction found are the gamma spectra, relative yield of gamma transitions, calcium-41 decay scheme, calcium-41 gamma energy, final level, angular distribution coefficients, mixing ratio, multipolarity, and transition strength. (JFP)

12846 PROPERTIES OF SOME LOW-LYING LEVELS OF ^{55}Co. Caldwell, S. E. Columbus, OH; Ohio State Univ. (1974). 196p. University Microfilms Order No. 74-24,302.

Thesis (Ph. D.).

The experimental study of some low-lying states in ^{55}Co, produced via the reaction ^{54}Fe(^{3}He,dγ)^{55}Co using an incident energy of 11.0 MeV, was undertaken to provide lifetime and spin-parity information needed to improve the understanding of this nucleus. The Doppler-shifted gamma-ray spectra, taken in coincidence with the outgoing deuterons, were fitted by the lineshape analysis program DEWIT in order to determine the lifetimes. The mean lifetimes of states at 2162, 2560, 2930, 3318, and 4155 keV were found to be 141^{+30}_{-30}, 620^{+130}_{-90}, ≥ 590, 90^{+11}_{-11}, and 50^{+10}_{-4} fs, respectively. A triple angular correlation experiment, using the Litherland-Ferguson Method I, was undertaken to determine the spins of the same states. The results were not totally conclusive, but served to limit the possible spin assignments, when used in conjunction with the lifetime measurements and previous work done on this nucleus. (Diss. Abstr. Int., B)

12847 HALF-LIVES OF SOME COSMOGENIC RADIONUCLIDES: ^{7}Be, ^{46}Sc, ^{54}Mn, ^{56}Co, and ^{65}Zn. Cressy, P. J. Jr. (Goddard Space Flight Center, Greenbelt, MD). Nucl. Sci. Eng.; 55: No. 4, 450-451(Dec 1974).

The decay of five radionuclides used as calibration sources in cosmogenic radionuclide studies was followed for from 3 to 11 half-lives. Least-squares analyses of the gamma-ray counting data yielded the following half-life values: ^{7}Be, 53.0 ± 0.3 days; ^{46}Sc, 84.34 ± 0.13 days; ^{54}Mn, 312.6 ± 0.8 days; ^{56}Co, 78.4 ± 0.5 days; and ^{65}Zn, 244.3 ± 0.4 days. (1 table) (auth)

12848 YIELD OF PHOTONEUTRONS FROM IRON, COPPER, AND LEAD DURING ABSORPTION OF 600-MeV BREMSSTRAHLUNG BEAMS. Roslik, S. F. Kratk. Soobshch. Fiz.; No. 2, 3-9(1974). (In Russian).

The dependence of the yield of photoneutrons generated by a 600-MeV bremsstrahlung beam on the thickness of absorbers of Fe, Cu, and Pb was measured. It was shown that the photoneutron yield is, at least weakly, dependent on the energy of accelerated electrons. (tr-auth)

12849 LEVELS OF ^{58}Ni. Nann, H.; Benenson, W. (Cyclotron Laboratory and Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 10: No. 5, 1880-1888 (Nov 1974).

The ^{58}Ni(p, t)^{56}Ni reaction was studied at 40 and 45 MeV beam energy. An energy resolution of 10-25 keV permitted observation of 60 levels with excitation energy up to 10.5 MeV. Spin and parity are assigned to levels which were excited with characteristic angular distributions. These include 0^+ states at 3.95, 5.00, 6.44, 7.91, 9.92, 9.99, and 10.02 MeV. (auth)

12850 SYSTEMATICS OF THE (^{3}He,p) REACTION ON SOME f-SHELL NUCLEI. Hardie, G. (Western Michigan University, Kalamazoo, Michigan 49001 and Argonne National Laboratory, Argonne, Illinois 60439); Gloeckner, D.; Meyer-Schützmeister, L.; Braid, T.H. Phys. Rev. C 10: No. 5, 1829-1845 (Nov 1974).

Using the Argonne split-pole magnetic spectrograph, the ^{43}Ca(^{3}He,p)^{45}Sc reaction was studied at E(^{3}He) = 17 MeV and with a range of angles from 7 to 55°. From the measured proton angular distributions the orbital angular momenta transferred (L_{np}) by the n-p pair were obtained. In addition, at the same bombarding energy and at several angles, cross sections for $L_{np} = 0$ and $0 + 2$ were measured for the (^{3}He,p) reaction with ^{46,48,50}Ti and ^{45}Sc targets. For these and other f-shell nuclei, systematics of the cross sections for $L_{np} = 0$ and the sum of the differential cross sections for $L_{np} = 0 + 2$ will be discussed. In particular we found that for odd-A targets the $L_{np} = 0 + 2$ sums are significantly smaller than the average for even-even f-shell targets. Two-particle spectroscopic amplitudes are calculated for transitions to ^{44}Sc, ^{45}Sc, ^{46}Sc, ^{47}Ti, ^{49}Sc, and ^{48}V using an $(f_{7/2})^n$ model and for transitions to ^{44}Sc, ^{45}Sc, ^{46}Sc, and ^{48}Sc using an $(f_{7/2}p_{3/2})^n$ model. Both models are based on an inert ^{40}Ca core. Zero-range distorted-wave Born-approximation calculations are then performed with these amplitudes. Reasonable agreement is found for the ratio of $L_{np} = 0 + 2$ to $L_{np} = 0$ strength with both models. (auth)

12851 NUCLEAR STRUCTURE OF CALCIUM ISOTOPES FROM INELASTIC α SCATTERING. de Voigt, M.J.A.; Cline, D.; Horoshko, R.N. (Nuclear Structure Research Laboratory, University of Rochester, Rochester, New York 14627). Phys. Rev. C 10: No. 5, 1798-1818 (Nov 1974).

Angular distributions were measured for elastic and inelastic α scattering from ^{40}Ca at 24.0, 28.5, and 31.0 MeV, from ^{41}Ca at 24.0 MeV and from ^{43,44}Ca at 25.5 MeV. Analyses in terms of distorted-wave Born-approximation and coupled-channel theory, employing a vibrational collective model form factor, yield inelastic transition strengths and many new spin and parity assignments or restrictions for levels in ^{40,41,43,44}Ca. The inelastic multipole transition strengths are in excellent agreement with known electromagnetic strengths. Quadrupole strengths are interpreted in terms of the coexistence model. The data imply that the ground-state excited-core admixtures to $(fp)^n$ spherical configurations are 4% in ^{48}Ca, 10% in ^{40,41}Ca, 14% in ^{43}Ca, and 30% in ^{42,44}Ca. The octupole inelastic strength is strong and mainly localized in the lowest 3^- state in ^{40}Ca, but becomes more fractionated and weaker with addition of neutrons and exhibits in ^{41}Ca characteristic weak-coupling fragmentation of the lowest 3^- state in ^{40}Ca. These results are consistent with previous observations that the structure of the ^{41}Ca ground state is with high purity a $1f_{7/2}$ neutron coupled to the ^{40}Ca ground state. (auth)

12852 (^{16}O, ^{15}N) AND (^{12}C, ^{11}B) REACTIONS ON ^{54}Fe AND ^{62}Ni AT E(^{16}O) = 104 MeV AND E(^{12}C) = 78 MeV. Becchetti, F.D. (Cyclotron Laboratory, Physics Department, The University of Michigan, Ann Arbor, Michigan 48105 and Lawrence Berkeley Laboratory, Berkeley, California 94720); Harvey, B.G.; Kovar, D.; Mahoney, J.; Zisman, M.S. Phys. Rev. C 10: No. 5, 1846-1855 (Nov 1974).

The (^{12}C, ^{11}B) and (^{16}O, ^{15}N) reactions on targets of ^{54}Fe and ^{62}Ni have been studied at bombarding energies far above the Coulomb barrier: $E(^{12}C) = 78$ MeV and $E(^{16}O) = 104$ MeV, respectively. The reaction mechanism appears to be direct and is adequately described with the distorted-wave Born approximation, provided recoil effects are included. A comparison of heavy-ion and light-ion analyses permits j assignments to be made for some levels by utilizing the j dependence of the heavy-ion reactions. (auth)

12853 HIGH-SPIN STATES IN ^{44}Ti AND ^{44}Sc. Kolata, J.J.; Olness, J.W.; Warburton, E.K. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 10: No. 5, 1663-1670 (Nov 1974).

We have investigated high-spin staes in ^{44}Ti and ^{44}Sc with the ^{28}Si(^{19}F, p2nγ)^{44}Ti and ^{28}Si(^{19}F, 2pnγ)^{44}Sc reactions at 45-55 MeV. Angular distribution, linear polarization, and γ-γ coincidence data on the emitted γ rays allowed us to construct decay schemes for states in ^{44}Ti and ^{44}Sc, and to suggest likely spin and parity assignments for most of these states. In each case, positive-parity levels with spin up to the maximum value permitted within a $(f_{7/2})^4$ shell-model space were populated. Results of lifetime measurements for several of these states are given, and a comparison is presented of the level energies and some transition strengths to the predictions of shell-model calculations. (auth)

12854 NUCLEAR STRUCTURE OF ^{43}Sc. IV. PROTON ELASTIC SCATTERING AND ISOBARIC ANALOG STATES. Manthuruthil, J.C.; Poirier, C.P.; Maripuu, S.; Anderson, W.A. (Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio 45433). Phys. Rev. C 10: No. 5, 1678-1687 (Nov 1974).

High-resolution measurements of the differential cross section for elastic proton scattering on ^{42}Ca have been performed in the energy regions E_p = 1230-1250, 1770-2170, 2440-2530, 2700-2800, and 3000-3250 keV. Thirty-six resonances were observed. For all resonances, the proton orbital angular momenta were determined and, in many cases, unique spin assignments were made. Partial proton widths are given for all resonances. Many of the observed $p_{1/2}$ and $p_{3/2}$ resonances are tentatively identified as the isobaric analogs of states in ^{43}Ca. In addition to the elastic proton measurements, γ-ray spectra were obtained at the isobaric analog states corresponding to the 2041-keV ($J^\pi = 3/2^-$) and 2607-keV ($J^\pi = 1/2^-$) states in ^{43}Ca. The results are compared with the predictions of a shell model calculation using the realistic Kuo-Brown interaction. (auth)

12855 EFFECT OF N* (1236) ON RADIATIVE MUON CAPTURE IN CALCIUM. Ohta, K. (Institute of Physics, University of Tokyo, Komaba, Meguro-ku, Tokyo 153, Japan). Phys. Rev. Lett. 33: No. 25, 1507-1510 (16 Dec 1974).

Influence of the one-pion exchange current brought about by the N* (1236) excitation is considered for the photon spectrum of radiative muon capture in calcium. It is found that the relative rate of radiative to ordinary muon capture is substantially lowered and that the discrepancy between partial conservation of axial-vector current theory and experiment is removed. (auth)

12856 GAMMA RAYS OBSERVED FROM 100-MeV PROTONS INTERACTING WITH ^{56}Fe AND ^{58}Ni. Chang, C.C.; Wall, N.S. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742); Fraenkel, Z. Phys. Rev. Lett. 33: No. 25, 1493-1496 (16 Dec 1974).

Gamma radiation from 100-MeV protons incident on targets of ^{58}Ni and ^{56}Fe has been observed. Residual nuclei were identified by using the known γ rays. Some of the strongest γ rays observed involved residual nuclei equivalent to the target nucleus minus one to three α particles. These results can be understood on the basis of a pre-equilibrium stage involving an intranuclear nucleon-nucleon cascade followed by an evaporation process. (auth)

12857 ALLOWED β-DECAY WITH HARMONIC OSCILLATOR NUCLEONIC WAVEFUNCTIONS. Wilkinson, D. H. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., A; 232: No. 1, 93-98 (28 Oct 1974).

The effect of the use of harmonic oscillator nucleonic wave functions for the definition of the phase space factor for allowed β-decay is investigated for A < 60; results are presented in figures. (auth)

12858 SPECTROSCOPY OF ^{41}Sc BY RESONANT SCATTERING OF PROTONS: OBSERVATION OF AN INTERMEDIATE STRUCTURE. Mittig, W.; Cassagnou, Y.; Cindro, N.; Papineau, L.; Seth, K. K. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). Nucl. Phys., A; 231: No. 2, 316-333(14 Oct 1974).

Excitation functions of elastic and inelastic scattering of protons on ^{40}Ca were measured for incident proton energies between 4.8 and 8.2 MeV. Spin and parity assignments and partial width determinations of ^{41}Sc states between 5.8 and 8.7 MeV excitation energy were made on the basis of quantitative analyses of the data for the different inelastic channels. Intermediate structure was identified in the excitation function for the inelastic scattering to the 3^- (3.73 MeV) state in ^{40}Ca. This was interpreted as being due to the presence of a state in ^{41}Sc which consists primarily of the core nucleus ^{40}Ca in its 3^- state with a 2p particle weakly coupled to it. (auth)

12859 NUCLEAR SPECTROSCOPY IN ^{48}V VIA THE ^{34}S(^{16}O,pn)^{48}V REACTION. Taras, P.; Haas, B.; Vaillancourt, R. (Montreal Univ., Quebec (Canada). Lab. de Physique Nucleaire). Nucl. Phys., A; 232: No. 1, 99-124(28 Oct 1974).

The electromagnetic decay of 18 bound states in ^{48}V were studied via the ^{34}S(^{16}O,pn)^{48}V reaction, at incident ion energies of 30 to 36 MeV. At these energies pn, 2pn, 2p, αp, αn and 2n exit channels were open. Spins and parities of the levels as well as the branching and mixing ratios of their decay γ-rays were obtained from angular distribution, excitation function, and high resolution γ-γ and n-γ coincidence measurements. Six, and possibly seven, members of a very pure rotational negative parity band were identified. This band is based on a 1^- low lying core excited state with probable configuration $(\pi d^3_{/2})^{-1}$ $(\pi f^7_{/2})^4$ $(\nu f^7_{/2})^5$. (auth)

12860 RESONANCES IN THE REACTION ^{56}Fe(p,γ)^{57}Co. Esat, M. T.; Leslie, J. R.; McLatchie, W. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). Nucl. Phys., A; 232: No. 1, 139-156(28 Oct 1974).

Resonances in the reaction ^{56}Fe(p,γ)^{57}Co were surveyed over the energy range $1.2 \lesssim E_p \lesssim 1.5$ MeV wherein the analogs of the ground state ($J^\pi = 1/2^-$), 0.014 MeV state ($J^\pi = 3/2^-$) and 0.136 MeV state ($J^\pi = 5/2^-$) of ^{57}Fe are expected to occur. Gamma-ray angular distributions have been used to establish resonance and bound-state spins, and decay schemes have been determined. The analogue resonances appear to be severely fragmented, however the density of resonances of a given spin correlates quite well with (^{3}He,d) results and with the expected analogue-state positions. (auth)

12861 SPIN DEPENDENCE OF THE NUCLEAR LEVEL DENSITY FROM ANGULAR DISTRIBUTIONS OF (α,n) REACTIONS. Hille, P.; Sperr, P.; Hille, M. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.); Rudolph, K.; Assmann, W.; Evers, D. (Muenchen Univ. (F. R. Germany). Sektion Physik). Nucl. Phys., A; 232: No. 1, 157-175(28 Oct 1974).

The spin dependence of the nuclear level density of ^{49}Cr, ^{57,59}Ni, ^{62}Cu, ^{61,63,65}Zn, ^{93}Mo, ^{96}Tc, ^{95}Ru and ^{118}Sb was determined by deducing spin cut-off factors from measured angular distributions of neutrons from the ^{46}Ti, ^{54,56}Fe, ^{59}Co, ^{58,60,62}Ni, ^{90}Zr, ^{93}Nb, ^{92}Mo and ^{115}In(α,n) reactions. For low energies of the emitted neutrons the angular distributions are symmetrical around 90° as expected for compound nuclear reactions. In most cases the anisotropy is of the order of 10%. The absolute cross sections agree well with the predictions of the statistical model of nuclear reactions including angular momentum. Experimental information on the energy dependence of relevant level densities given in recent compilations was used in the calculations. The spin cut-off factors were parametrized by effective moments of inertia for the final nuclei. Most of these are somewhat smaller than the moment of inertia of a rigid nuclear sphere assuming a radius parameter $r_0 = 1.25$ fm. (auth)

12862 MEASUREMENT OF MEAN LIFETIMES, γ-RAY ANGULAR DISTRIBUTIONS AND LINEAR POLARIZATIONS FOR LOW-LYING LEVELS OF ^{50}V. Rickel, D. G.; Roberson, N. R. (Duke Univ., Durham, N. C. (USA)); Nelson, R. O.; Williams, J. R.; Tilley, D. R. (North Carolina State Univ., Raleigh (USA)). Nucl. Phys., A; 232: No. 1, 200-214(28 Oct 1974).

Levels of ^{50}V were populated with the ^{50}Ti(p,n)^{50}V reaction at E_p = 4.50, 4.62 and 4.80 MeV. Gamma rays were measured in singles. From Doppler shift attenuation measurements mean lifetimes were deduced for 9 levels below E = 2 MeV. The J^π assignments for 8 of these levels follow from γ-ray angular distribution and linear polarization measurements. The transition strengths were compared with calculations based on the wave functions of McCullen, Bayman and Zamick. (auth)

12863 BAND MIXING IN ^{49}Cr AND ^{47}V: IMPORTANCE OF A CORRECT TREATMENT OF HOLE EXCITATIONS AND THE J^2 TERM. Haas, B.; Taras, P.; Styczen, J.; Chevallier, J. (Centre National de la Recherche Scientifique, 67-Strasbourg (France). Lab de Physique du Noyau et de Physique des Particules). Phys. Lett., B; 52: No. 2, 146-148(30 Sep 1974).

Band mixing calculations treating correctly the j^2 term and hole excitations were undertaken on the cross-conjugate pair ^{47}V, ^{49}Cr. It is found that such a treatment gives rise to appreciable differences from the usual band mixing calculations of nuclei in the 1f-2p shell. The results are in good agreement with the experimental level schemes. (auth)

12864 SPECTROSCOPIC FACTORS AND E3 TRANSITION RATES IN ^{39}K. Micklinghoff, M.; Castel, B. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics). Phys. Lett., B; 52: No. 2, 166-168(30 Sep 1974).

The calculation for ^{39}K differs from the previous particle-core model by taking explicitly into account the perturbation diagrams resulting from the particle-hole structure of the phonon and the ground state correlations in the ^{40}Ca core. These diagrams are shown to be important for the correct description of the low lying energy levels of ^{39}K as well as for reproducing the observed spectroscopic strength of the negative parity states populated by pickup reactions on ^{40}Ca. (auth)

12865 ARE COMPLEX FORM FACTORS IMPORTANT IN MICROSCOPIC DESCRIPTIONS OF INELASTIC ^{3}He AND α SCATTERING. Morsch, H.-P. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Phys. Lett., B; 52: No. 2, 125-127(30 Sep 1974).

Microscopic and collective model descriptions of inelastic ^{3}He and α scattering on ^{40}Ar are compared. In the microscopic description (without imaginary form factor) the strength of ^{3}He scattering relative to that of α scattering is well described, whereas in the collective model the description of ^{3}He scattering contains features which are quite different from those for α scattering. Such differences are not consistent from a microscopic point of view. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 12806, 12844, 12847, 12852, 12857, 12861, 12878, 12879, 12881, 12883, 12888, 12896, 12902, and 13013.

12866 (COO-2186-8) NUCLEAR ACCELERATOR LABORATORY ANNUAL REPORT, JUNE 1, 1972-MAY 31, 1973. (State Univ. of New York, Albany (USA). Dept. of Physics). Jun 1973. 78p. Dep. NTIS $7.00.

The research program during the period 1972-73 is presented. Eighteen papers on work with the accelerator at SUNY/Albany and thirteen papers on collaborative work with other institutions are given. Computer and accelerator operation, theses, grants, personnel, publications, and meeting presentations are also included. Four of the papers are separately title listed. (RWR)

For title listings of individual papers see: 12081, 12821, 12841, and 12877.

12867 NUCLEAR DATA SHEETS FOR A = 62. Verheul, H. (Univ., Amsterdam). Nucl. Data Sheets; 13: No. 4, 443-491(Dec 1974).

The 1967 version of the Nuclear Data Sheets for A = 62 was revised on the basis of experimental data received before January 15, 1974. In the Data Sheets experimental data are presented; in the Summary Sheets adopted values for the measured quantities, J^π assignments, and discussions of the adopted decay and level schemes are given. Progress has been made since 1967 as many new and more accurate data are available. Some problems, such as which of the two measured half-lives of ^{62}Co belongs to the ground state and what is the energy of the isomeric state, have been resolved. Other problems with conflicting or inconsistent experimental data have arisen, e.g., a small systematic difference in the values for the energies of the ^{62}Ni γ rays, the question of whether or not ^{64}Zn has more than one excited 0^+ state below 3900 keV, and others. A first report was made on the observation of the nucleus ^{62}Ga. The reported half-life is 117.8 ms. The assignment is not yet completely certain from the quoted report. If this nucleus decays 100% to the ^{62}Zn ground state, the log ft is 3.5, which is characteristic of a $0^+ \rightarrow 0^+$ superallowed transition. (auth)

12868 DECAY OF ^{74}Kr AND ITS DAUGHTER. Coban, A. (Univ. of Manchester, Eng.). J. Phys., A (London); 7: No. 14, 1705-1715(21 Sep 1974).

A level scheme has been established for ^{74}Br by observing the γ rays following the decay of ^{74}Kr. The decay of its daughter nucleus ^{74}Br has also been studied, and comparison of this and previous work leads to the identification of an isomeric state in ^{74}Br, and it is shown that the new state in ^{74}Br which decays by β^+ emission possesses $J^\pi = 0^-$ or 1^- in contrast to $J^\pi = 4^-$ for the previously observed state of ^{74}Br. (auth)

12869 REACTION MECHANISM IN THE SCATTERING OF PROTONS. Vladuca, G. (Univ. Bucharest). Stud. Cercet. Fiz.; 26: No. 3, 283-306(1974). (In Rumanian).

The discussion covers the unified theory of nuclear reactions, the complex potential model (coupled channels), the optical model, direct interactions, the statistical model, and the theoretical analysis of experimental data of the elastic and inelastic scattering of protons from ^{60,64}Ni. (JFP)

12870 IMPROVED LIFETIME MEASUREMENTS IN ^{61}Cu VIA THE ^{61}Ni(p, nγ) REACTION. Braga, R.A.; Sarantites, D.G. (Department of Chemistry, Washington University, St. Louis, Missouri 63130). Phys. Rev. C 10: No. 5, 2109-2110 (Nov 1974).

The effective stopping power for Cu ions slowing in a Ni environment was deduced for an average initial recoil velocity of 0.0025 of c. An improved value of 41 ± 5 fsec for the mean lifetime of the 2088.7-keV level is reported. (auth)

12871 ANOMALIES IN THE ^{72}Ge(α,n)^{75}Se REACTION NEAR ISOBARIC ANALOG RESONANCES IN ^{76}Se. Elwyn, A.J.; Monahan, J.E. (Argonne National Laboratory, Argonne, Illinois 60439); Lemming, J.F.; Rapaport, J.; Sample, M. Phys. Rev. C 10: No. 5, 1939-1947 (Nov 1974).

Anomalies in the excitation function of the reaction ^{72}Ge(α,n)^{75}Se are compared with isobaric analog resonances observed in the ^{75}As(p,n)^{75}Se reaction. The results are consistent with the interpretation that the same analog resonance is populated in both reactions. Since the (α,n) reaction through isobaric analog states is isospin forbidden in both entrance and exit channels, these results imply some isospin-breaking mechanism for the excitation of analog resonances via α and/or neutron channels. (auth)

12872 ^{87}Sr(d, p)^{88}Sr REACTION. Seth, K.K. (Northwestern University, Evanston, Illinois 60201 and Centre d'Etudes Nucléaires de Saclay, 91 Gif-sur-Yvette, France); Buzard, K.A.; Picard, J.; Bassani, G. Phys. Rev. C 10: No. 5, 1928-1938 (Nov 1974).

Neutron particle-hole states in ^{88}Sr have been studied by means of the reaction ^{87}Sr(d, p)^{88}Sr at E_d = 12 MeV. It has been determined that the earlier reported transitions to presumed states at 4744 and 5780 keV in ^{88}Sr arise mainly from transition to the ground state and the first excited state in ^{89}Sr. Spectroscopic strengths for states of the multiplets $[g_{9/2}^{-1}\, d_{5/2}]$ and $[g_{9/2}^{-1}\, s_{1/2}]$ have been determined by detailed distorted-wave Born-approximation analysis. J^π assignments are suggested on the basis of sum rules and comparison with other experiments. Matrix elements for two-particle effective interactions are derived. (auth)

12873 STUDY OF THE GERMANIUM ISOTOPES WITH THE (p,t) REACTION. Ball, G. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Fournier, R.; Kroon, J.; Hsu, T. H.; Hird, B. (Ottawa Univ., Ontario (Canada)). Nucl. Phys., A; 231: No. 2, 334-348(14 Oct 1974).

The levels of ^{70,71,72,74}Ge were investigated with the (p,t) reaction at 20 MeV. Strong transitions to the ground state and to the 2_1^+ and 3_1^- collective levels were observed for all even isotopes. A comparison of the experimental angular distributions with those calculated assuming a closed ^{70}Ge core indicates that only ~15% of the observed ground state L = 0 transition strength comes from $(1g_{9/2}^2)^2$ and $(2p_{1/2}^2)^2$ pick up. The excitation energies and L-transfers obtained in the present work are found to be in generally good agreement with previous data. (auth)

12874 J-DEPENDENCE OBSERVED IN ^{61,62}Ni(p,d) REACTIONS AT 40 MeV. Kong-A-Siou, D. H.; Chien, W. S. (Michigan State Univ., East Lansing (USA). Cyclotron Lab.). Phys. Lett., B; 52: No. 2, 175-178(30 Sep 1974).

The angular distributions of several l = 3 transitions observed in the ^{61,62}Ni(p,d) reactions demonstrate a very stable j-dependence over a range of intensities and excitation energy. (auth)

12875 SPIN DEPENDENCE IN INELASTIC PROTON SCATTERING FROM ODD-A NUCLEI. Reif, R.; Schmidt, R. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik). Phys. Lett., B; 52: No. 2, 163-165(30 Sep 1974).

A DWBA analysis mixing single-particle and core excitations shows that the experimentally observed spin dependent effect in the inelastic proton scattering reflects an intermediate coupling situation in the structure of odd 2p, 1f-shell nuclei. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 11335, 12175, 12309, 12540, 12806, 12825, 12857, 12861, 12901, 12905, 12924, and 13275.

12876 (AERE-PR/NP-21, pp 10-13) NEUTRON RESONANCE CAPTURE GAMMA-RAY STUDIES. 1. ^{93}Nb(n,γ)^{94}Nb REACTION. Thomas, B. W.; Haste, T. J. (Oxford Univ.). Aug 1974.

12877 (COO-2186-8, pp 54-59) RESONANCE NEUTRON CAPTURE IN Ru ISOTOPES. Rimawi, K. (State Univ. of New York, Albany); Garg, J. B.; Chrien, R. E.; Cole, G.; Wasson, O. A. Jun 1973.

In Nuclear Accelerator Laboratory annual report.

12878 (INDC(CCP)-38/U, pp 61-120) RECOMMENDED VALUES FOR THE ENERGY DEPENDENCE OF COEFFICIENTS IN A LEGENDRE POLYNOMIAL EXPANSION OF ELASTIC SCATTERING CROSS SECTIONS. Bazazyants, N. O.; Zabrodskaya, A. S.; Larina, A. F.; Nikolaev, M. N. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

Recommended data for the energy dependence of the moments of the angular distributions of elastically scattered neutrons in the range from 0.1 to 15 MeV are given for 42 nuclei from deuterium to ^{239}Pu. All available data up to 1967 were included. (42 tables) (RWR)

12879 (INDC(CCP)-42/U, pp 10-12) EXPERIMENTAL CROSS SECTIONS FOR NUCLEAR REACTIONS INVOLVING NEUTRONS WITH ENERGIES OF ABOUT 14 MeV. Maslov, G. N.; Nasyrov, F.; Pashkin, N. F. Aug 1974. Translated from Russian.

In nuclear constants, No. 9.

Cross sections for (n,2n), (n,α), (n,p), (n,n'), and (n,d) + (n,np) reactions on various nuclides from A = 23 to 208 were measured at 14.2 and 14.6 MeV. Gamma energies and yields are also tabulated. Total cross sections for reactions in air, nitrogen, and oxygen were also measured at 14.1 MeV. (1 table) (RWR)

12880 (JINR-P3-8140) REACTION (n, $\gamma\alpha$) FOR RESONANCE NEUTRONS. Popov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 30p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

A review of (n, $\gamma\alpha$) investigations performed to gain information about γ transitions between compound states is given. The outlook for such investigations is discussed. (7 figures, 4 tables) (auth)

12881 (LA-5750) TABLE OF CALCULATED NUCLEAR PROPERTIES. Seeger, P. A.; Howard, W. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 178p. Dep. NTIS $7.60.

This report supersedes LA-3751.

An atomic mass formula based on the liquid-drop model with shell and deformation energies determined from the Nilsson model and BCS pairing energy was adjusted simultaneously to ground-state binding energies and to fission barrier heights. A table of calculated values for 8001 nuclei is given. (1 figure, 2 tables) (auth)

12882 (ORO-3346-154) NUCLEAR AND X-RAY SPECTROSCOPY WITH RADIOACTIVE SOURCES. Tenth Annual Progress Report, February 1, 1974-January 31, 1975. Fink, R. W. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). 31 Oct 1974. Contract AT(40-1)-3346. 38p. Dep. NTIS $5.00.

The period is reviewed in an introduction. Then papers are presented according to the following outline: Nuclear spectroscopy with radioactive sources (nuclear systematics, nuclear decay scheme studies, on-line nuclear decay studies at UNISOR, and orbital electron capture studies) and x-ray and electron spectroscopy with radioactive sources (list of publications and presentations at meetings, K-shell and L- and M-subshell investigations, and electron detector determination of L_1 subshell fluorescence yields). Also included are equipment added during 1974, personnel, and a summary list of publications and presentations at meetings. One of the papers is separately title listed. (RWR)

For a title listing of an individual paper see: 12923.

12883 (UCID-16136, pp 3-5) NUCLEAR CROSS-SECTION CALCULATIONS. Gardner, D. G.; Brownlee, J. L.; Delucchi, A. 10 Oct 1972.

In status report to USNDC.

12884 (UCRL-76049) EXPERIMENTAL STUDIES OF VIBRATIONLIKE NUCLEI THROUGH THEIR ELECTROMAGNETIC PROPERTIES. Meyer, R. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Sep 1974. 40p. (CONF-740992-1). Dep. NTIS $5.25.

From conference on vibrational nuclei; Zagreb, Yugoslavia (23 Sep 1974).

A number of improvements in the description of vibrationlike nuclei have been made by the inclusion of multiparticle configurations. The influence of multiparticle effects on vibrationlike nuclei can be well illustrated by a discussion of the odd-mass nuclei in the region Z $\approx$ 50 and N < 82. After a description of experimental techniques, how the inclusion of three-quasi-particle effects can provide a model consistent with the results of various experimental studies is examined. These include the 2p-1h states in the odd-mass Sb nuclei, three-particle clustering in the I nuclei, and one-proton-two-neutron ($\pi\nu\nu$) configurations near the N = 82 shell closure. Next, how the inclusion of the Coriolis force may explain the rotationlike structure observed in spectroscopy studies of the La and In nuclei is discussed. Then the way in which gamma-ray spectroscopy studies may explain the apparent deviation from vibrationlike character of the N = 81 nuclei is considered. Finally, the systematics of higher-order electromagnetic processes in the Sn region is treated. In each case, a short description of the deviation from simple vibrationlike character is followed by a specific case; in this way a detailed comparison of the various nuclear models currently available with experimental data is possible. In summary, it is shown how multiparticle and high-j shell-model states can account for the observed deviation of nuclear properties from a simple vibration-coupled picture. (11 figures, 112 references) (RWR)

12885 (UUIP-868) G-FACTOR OF THE FIRST EXCITED STATE IN ^{96}Mo. Johansson, K.; Karlsson, E.; Norlin, L. O. (Uppsala Univ. (Sweden). Fysiska Institutionen). Mar 1974. 17p. Dep. NTIS (U. S. Sales Only) $4.00.

The g-factor of the first $^3/_2^+$ excited level in ^{95}Mo was determined by perturbing the angular correlation of the 582-204 keV and the 835-204 keV $\gamma\gamma$ cascades in three different external fields. The measurement was performed with an Ag^{95}Tc source, and the result for the g-factor is g = -0.246 ± 0.010. (auth)

12886 (UUIP-869) MEASUREMENTS OF B(E2,$0^+ \rightarrow 2^+$) FOR EVEN Xe ISOTOPES. Edvardson, L. O.; Norlin, L. O. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 15p. Dep. NTIS (U. S. Sales Only) $4.00.

Transition moments and lifetimes have been deduced from measurements of the Coulomb excitation cross sections for ^{128,130,132,134,136}Xe isotopes. The results are for B(E2) [0.77(6); 0.60(6); 0.49(4); 0.38(6); 0.17(3)]$e^2 \times 10^{-48}$ cm^4 and for $\tau(2^+)$ [31.6 (24); 15.3(15); 6.3(6); 2.4(4); 0.59(15)] psec going from ^{128}Xe to ^{136}Xe. (auth)

12887 GAMMA COINCIDENCES IN THE DECAY OF 12.5 d ^{126}Sb. Lin, C. C.; Subrahmanyam, V. (Boston Coll., Chestnut Hill, MA). J. Inorg. Nucl. Chem.; 36: No. 11, 2626-2628(Nov 1974).

The energy levels of tellurium-126 have been reported by a number of workers through (p,p), (α,2nγ), (d,p), and (p,t) nuclear reaction studies. The population of these levels in radioactive decay is limited to the observation of few gamma rays in the decay of 19 m Sb^{126m} and EC/$^+$ decay of ^{126}I. The reported work on the decay of ^{126}Sb was by Orth et al. (Phys. Rev., C3: 2402 (1971)), where NaI(Tl) detectors were employed. An investigation was therefore undertaken to establish the various gamma rays and their coincidence relations in the beta decay of ^{126}Sb. The results are presented and discussed. (auth)

12888 GAMMA SPECTROSCOPY IN HEAVY ION PHYSICS. Delaunay, J. (CEN de Saclay, Gif-sur-Yvette, France). Nukleonika; 19: No. 7-8, 607-623(1974).

The interesting and increasingly important role of heavy-ion (HI) projectiles in nuclear physics is considered. HI-induced reactions are currently widely utilized to study the underlying reaction mechanism, to investigate nuclear structure, and to systematize nuclear levels. A particular emphasis is given to the in-beam study of γ rays induced by HI projectiles. (8 figures) (auth)

12889 INFLUENCE OF THE QUASIPARTICLE-PHONON INTERACTION ON THE STRUCTURE OF EXCITED STATES IN EVEN-EVEN SEMIMAGIC NUCLEI. Vdovin, A. I.; Stoyanov, S. (Joint Inst. for Nuclear Research, Dubna, USSR). Nukleonika; 19: No. 7-8, 717-719(1974).

The effect of coupling of two-quasi-particle and phonon excitations on the structure of a number of 4^+ and 5^- states of even-even semimagic nuclei is studied in the framework of the "pairing + multipole-multipole forces" model by using the quasi-boson approximation. Energies and B(E2, $4^+ \rightarrow 2^+$) values for these states are given for ^{116,118}Sn, ^{138}Ba, and ^{140}Ce as examples. (1 table) (auth)

12890 ISOMERIC CROSS SECTION RATIOS IN THE ^{110}Cd(p,n)^{110}In^{m,g} AND ^{116}Cd(p,n)^{116}In^{m_1,m_2} REACTIONS. Ionescu-Bujor, M.; Ivanov, E. A.; Plostinaru, D.; Zaharcu, M. (Inst. of Atomic Physics, Bucharest). Rev. Roum. Phys.; 19: No. 5, 559-560 (1974).

An investigation was made of the population yield, isomeric cross sections, and activation ratio was made in indium-116 excited by (p,n) reactions at 8 and 10 MeV. The isomeric cross section ratio for indium-110 was also measured. The results give evidence of the existence of a band of dynamically related levels belonging to a given configuration responsible for the departure from the statistical approach of the population yield of the 8^- level. (JFP)

12891 ENERGY SPECTRA OF PIONS AND Σ-HYPERONS PRODUCED FROM K^--CAPTURE. Goel, S. P. (Kurukshetra Univ., India); Prakash, Y. Indian J. Pure Appl. Phys.; 12: No. 8, 570-574(Aug 1974).

The energy spectra of pions and Σ-hyperons obtained from a computer simulation study of the capture of K^--mesons in emulsion nuclei are presented. The results are compared with the corresponding experimental results. The energy spectrum of Σ-hyperons lends support to the existence of nucleon clusters on

the surface of nuclei. The results indicate that $\Sigma^+\pi^\nu$ pairs or $\Sigma^\pm$-hyperons are not always emitted without any accompanying charged particle. One interesting result is that $\Sigma^\pm$-hyperons of energy <35 MeV are emitted from two-nucleon capture of K^--mesons also. In experimental work, such hyperons may be misidentified as originating from single nucleon K^--captures. (auth)

12892 UNIVERSAL DESCRIPTION OF THE SPECTRA OF THE ^{8}Li NUCLEI EMITTED BY EMULSION NUCLEI BY BOMBARDMENT WITH HIGH ENERGY PARTICLES. Bayukov, Yu. D.; Vorob'ev, L. S.; Kolganova, E. D.; Leksin, G. A.; Rabin, N. V.; Stolin, V. L.; Fedorov, V. B. JETP Lett. (USSR) (Engl. Transl.); 19: No. 12, 399-400(20 Jun 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 12, 781-784(20 Jun 1974).

It is shown that the spectra of fast ^{8}Li fragments from emulsion nuclei can be described by the universal function $\rho = (E/p^2)(1/\sigma_{tot})(d^2\sigma/d\Omega dp) = [(1.66 \pm \frac{0.27}{0.22}) \cdot 10^{-3}] \exp[-(4.6 \pm 0.6)p^2]$. (auth)

12893 ELECTRIC MONOPOLE TRANSITIONS BETWEEN 0^+ STATES IN ^{100}Ru. Koike, M.; Kawakami, H.; Komura, K.; Yamada, H. (Institute for Nuclear Study, University of Tokyo, Tanashi, Tokyo, Japan). Phys. Rev. C 10: No. 5, 1996-2001 (Nov 1974).

The electric monopole (E0) transitions from the first and second excited 0^+ states at 1130.3 and 1740.7 keV, respectively, in ^{100}Ru have been observed from the internal–conversion–electron studies of the decay of ^{100}Rh. The monopole strength for the first excited 0^+ state $\rho(E0; 0_1^+ - 0_g^+) < 0.11$ is deduced as an upper limit. The dimensionless ratios of the reduced E0- to E2-transition probabilities X are deduced:

$$X\left(\frac{E0; 0_1^+ - 0_2^+}{E2; 0_1^+ - 2_1^+}\right) = 0.011 \pm 0.001, \quad X\left(\frac{E0; 0_2^+ - 0_2^+}{E2; 0_2^+ - 2_1^+}\right) = 0.6 \pm 0.3.$$

The observed branching ratio of the monopole strength for the second excited 0^+ state is $\rho(0^+_2 - 0^+_g)/\rho(0^+_2 - 0^+_1) = 0.73 \pm 0.07$. The experimental results are compared with the theory on the basis of the collective vibrations of an axially and nonaxially deformed nucleus. (auth)

12894 HALF–LIFE OF THE 257 keV $1^+ \rightarrow 4^-$ TRANSITION IN ^{90}Nb. Courtney, W.J.; Delaune, C.I.; Nelson, J.W.; Fox, J.D. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 10: No. 5, 1922-1924 (Nov 1974).

The half–life of the 382 keV 1^+ state in ^{90}Nb has been determined by detecting the 257 keV conversion electron decay following the ^{90}Zr(p, n)^{90}Nb reaction induced by a chopped proton beam. The value obtained is 6.3 ± 0.2 ms, in good agreement with two earlier measurements but different from the value adopted in 1970 in Nuclear Data Tables. (auth)

12895 NEUTRON RESONANCE SPECTROSCOPY. XVI. ^{113}In, ^{115}In. Hacken, G.; Liou, H.I.; Camarda, H.S.; Makofske, W.J.; Rahn, F.; Rainwater, J.; Slagowitz, M.; Wynchank, S. (Columbia University, New York, New York 10027). Phys. Rev. C 10: No. 5, 1910-1916 (Nov 1974).

Results of neutron time-of-flight spectroscopy measurements for natural indium and separated ^{115}In, using the Nevis synchrocyclotron, are given. Transmission and self–indication measurements were made for a range of natural indium sample thicknesses and for a sample of 99.5% enriched $^{115}In_2O_3$. Resonance parameters E_0 and $g\Gamma^0_n$ are given to 2 keV. Part of the isotope assignment was made with the aid of ^{113}In raw capture data taken at Geel by C. Coceva. Some Γ_γ values were also obtained, from which we estimate $\langle\Gamma_\gamma\rangle$ to be 75 meV for ^{113}In (based on three levels), and 85 meV for ^{115}In (15 levels). The l = 0 strength function for ^{115}In is $10^4S_0 = 0.26 \pm 0.03$. Comparison of the $(g\Gamma_n^0)^{1/2}$ distribution with Porter–Thomas theory for ^{115}In shows that many p levels are observed. An estimate of the level detection sensitivity and a Bayes's theorem analysis allow a determination of the p strength function and its uncertainty: $10^4S_1 = 2.7 + 1.0$ or -0.7 for ^{115}In. We find $\langle D\rangle = (9.4 \pm 0.2)$ eV for ^{115}In s levels. (auth)

12896 CALCULATION OF AVERAGE (n,2n) CROSS-SECTIONS FOR FISSION NEUTRONS. Body, Z. T. (Inst. for Experimental Physics, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 351-354(1974).

Fission-spectrum-average (n,2n) cross sections were calculated from experimental excitation functions and from most probable (absolute) cross-section values at 14.7 MeV. These differential data were compared to those of integral origin as well as to those from the systematics of Calamand. (auth)

12897 NUCLEAR ORIENTATION OF ^{142}Pr IN Pr METAL. Smith, C. H.; Weyhmann, W. V. (Minnesota Univ., Minneapolis (USA)). Phys. Lett., B; 52: No. 2, 195-197(30 Sep 1974).

The anisotropy of γ-rays from oriented ^{142}Pr nuclei in Pr metal can be fitted to calculations utilizing electronic moments measured by neutron diffraction if it is assumed that zero-order matrix elements dominate the preceding first-forbidden β transition. The results select one of two possible solutions obtained in previous work. (auth)

12898 SEARCH FOR GIANT SPIN-FLIP TRANSITIONS IN ^{90}Zr AND ^{208}Pb. Cecil, F. E.; Garvey, G. T.; Braithwaite, W. J. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Nucl. Phys., A; 232: No. 1, 22-44(28 Oct 1974).

A search was made for the giant magnetic dipole resonance in ^{90}Zr and an associated state in ^{208}Pb. Among the experimental techniques employed in this search was the detection of inelastically scattered protons in coincidence with ground-state de-excitation γ-rays. No state in ^{90}Zr up to an excitation of 10.5 MeV or in ^{208}Pb between 5.0 to 6.0 MeV was observed with the desired characteristics. In ^{90}Zr, heretofore unidentified levels at 5.51, 5.89 and 6.42 MeV were determined to have $J^\pi = 1^-$. In ^{208}Pb $J^\pi = 1^-$ states were observed at 5.29, 5.51 and 5.94 MeV. The implications of these observations are discussed. (auth)

12899 MEASUREMENT OF THE QUADRUPOLE MOMENTS OF THE FIRST 2^+ STATES OF ^{130}Ba AND ^{134}Ba. Neiman, M.; Kalish, R.; Somayajulu, D. R. S.; Herskind, B. (Niels Bohr Institutet, Copenhagen (Denmark)); Genovese, F.; Grodzins, L. (Massachusetts Inst. of Tech., Cambridge (USA)). Phys. Lett., B; 52: No. 2, 189-191(30 Sep 1974).

The quadrupole moments of the first 2^+ states of ^{130,134}Ba were measured using the reorientation precession technique. Prolate deformations were determined for both nuclei. The quadrupole moments found were $Q = -0.33 \pm 0.24$ b and -0.31 ± 0.24 b for ^{130}Ba and ^{134}Ba, respectively. (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 12823, 12857, 12881, 12888, 12896, 12923, 12964, and 13015.

12900 (AERE-PR/NP-21, pp 41-44) MEASUREMENTS OF THE NEUTRON CROSS-SECTION OF NATURAL HAFNIUM AND ITS STABLE ISOTOPES. Moxon, M. C.; Jolly, J. E.; Endacott, D. A. J. Aug 1974.

12901 (ANU-P-604) OBSERVATION OF THE YRAST AND STATISTICAL CASCADES IN HEAVY-ION, xnγ REACTIONS. Newton, J. O.; Lisle, J. D.; Dracoulis, G. D.; Leigh, J. R.; Weisser, D. C. (Australian National Univ., Canberra. Dept. of Nuclear Physics). 1974. 12p. Dep. NTIS (U. S. Sales Only) $4.00.

The energy spectra and angular distributions of the yrast and statistical cascades in ^{160,162}Yb have been obtained from measurements of the ^{147,149}Sm(^{16}O,3n) and ^{148,150}Sm(^{16}O,4n) reactions. An average of about six yrast and six statistical γ-rays occur in the 4n reaction. The data suggest that the yrast γ-rays are mostly stretched E2. (2 figures, 1 table) (auth)

12902 (CEA-R-4627) MEASUREMENT OF THE (n, 2n) CROSS-SECTIONS FOR ^{56}Fe, ^{59}Co, ^{89}Y, ^{169}Tm, ^{175}Lu, ^{181}Ta, ^{197}Au, ^{209}Bi, ^{238}U, AND OF THE (n, 3n) CROSS-SECTION FOR ^{238}U FROM THRESHOLD TO 15 MeV INCIDENT NEUTRON ENERGY. Frehaut, J.; Mosinski, G. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1974. 53p. (In French). Dep. NTIS (US Sales Only) $5.75.

The (n, 2n) cross sections for ^{56}Fe, ^{59}Co, ^{89}Y, ^{169}Tm, ^{175}Lu, ^{181}Ta, ^{197}Au, ^{209}Bi, ^{238}U, and the (n, 3n) cross section for ^{238}U were measured from the threshold up to 15 MeV incident neutron energy by using the large Gd-loaded liquid scintillator method and the 12-MeV tandem Van de Graaff accelerator of Bruyères-le-Châtel as a pulsed neutron source. The (n, 2n) and (n, 3n) cross sections were normalized to the fission cross section of ^{238}U; they are obtained with a relative accuracy of 5% to 10%. The ratios of the (n, 2n) cross sections for the non-fissionable elements were obtained with an accuracy better than 5%. (12 figures, 3 tables) (auth)

12903 (CONF-741131-1) LIFETIMES OF HIGH-SPIN ROTATIONAL STATES BY THE DOPPLER-SHIFT RECOIL-DISTANCE TECHNIQUE. Johnson, N. R. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 49p. Dep. NTIS $5.50.

From international conference on gamma-ray transition probabilities; Delhi, India (11 Nov 1974).

Lifetime measurements on ^{154}Sm, ^{164}Dy, ^{232}Th, ^{238}U, and ^{236}U were made by the Doppler-shift recoil–distance technique in order to properly account for transition rates which is a critical test for any model. (JFP)

12904 (JINR-P6-8159) EXCITED STATES OF ^{158}Dy. Aleksandrov, A. A.; Baier, G. Yu.; Vylov, Ts.; Grigor'ev, E. P.;

Gromov, K. Ya.; Kalinnikov, V. G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

A decay scheme for the isomeric and ground states of ^{158}Ho is proposed. Quantitative information on the mixing of the wave functions of the different rotational bands in ^{158}Dy is obtained. There is introduced a large number of levels with energies > 2 MeV, and a statistical analysis of the properties of these levels was made. Conclusions are drawn on the fragmentation of 4^+(n523↓ + n521↑) states and on the possibility of interpreting the maximum of the β-decay strength function for levels in the 2.6-MeV region as a manifestation of the fragmentation of 1^- (n523↓−n651↑) states. (3 figures, 5 tables) (tr-auth)

12905 NEUTRON TOTAL CROSS SECTIONS OF SOME RARE-EARTH ELEMENTS BETWEEN 0.7 MeV AND 9.0 MeV. Kellie, J. D.; Hall, S. J.; Crawford, G. I.; Syme, D. B. C. B.; McKeown, J. (Univ. of Glasgow). J. Phys., A (London); 7: No. 14, 1758-1766(21 Sep 1974).

Measurements are presented of the total neutron cross sections of naturally occurring ^{57}La, ^{58}Ce, ^{59}Pr, ^{60}Nd, ^{62}Sm, ^{64}Gd, ^{66}Dy, ^{67}Ho, ^{68}Er, and ^{70}Yb over the energy range 0.7 MeV to 9.0 MeV. The results are compared with theoretical cross sections evaluated using the spherical generalized optical potential of Wilmore and Hodgson (Nucl. Phys.; 55: 673-94 (1964)). Considerable resonant structure is found in the total cross section of ^{58}Ce, and there is evidence of an abrupt onset of nuclear deformation as the neutron number reaches 90. (auth)

12906 MULTIPOLE MIXING RATIOS OF GAMMA RAYS EMITTED IN THE DECAY OF POARIZED ^{160}Tb. Fox, R. A.; Hamilton, W. D.; Warner, D. D. (Univ. of Sussex, Eng.). J. Phys., A (London); 7: No. 14, 1716-1725(21 Sep 1974).

It has been demonstrated that successful nuclear polarization of terbium isotopes can be achieved by making use of the high internal field experienced when the activity is dissolved in a gadolinium lattice cooled to 10 mK. The isotope ^{160}Tb was chosen as an example, since some features of the decay have already been established by γγ directional correlation methods. The directional distribution of the emitted radiation was used to determine the E2:M1 and M2:E1 multipole mixing ratios of thirteen γ ray transitions in ^{160}Dy. There is a general agreement with earlier results. Furthermore, the following values of previously undetermined M2:E1 multipole mixing ratios, $\delta(E_\gamma)$, were found: $\delta(310) = -0.020(14)$, $\delta(337) = 0.039(32)$, $\delta(1003) = -0.004(17)$, $\delta(1103) = -0.156(25)$, $\delta(1115) = 0.000(12)$, $\delta(1200) = -0.017(8)$, $\delta(1312) = -0.017(8)$. (auth)

12907 NUCLEAR DATA SHEETS FOR A = 161. Tuli, J. K. (Coll. House, Hyderabad, India). Nucl. Data Sheets; 13: No. 4, 493-547(Dec 1974).

Nuclear data based on the available experimental information on A = 161 nuclides are presented. All nuclides with $64 \le Z \le 72$ for this A value are known. The 4.2-m Z = 70 (Yb) isobar has been reported only recently; this activity was assigned earlier to A = 160. An isomer in ^{161}Lu is known; however, nothing is known about its ground state. It is also not certain if the 17-s state in ^{161}Hf is indeed its ground state. Level properties, spin assignments, comments and gamma-ray properties precede the experimental data for each nuclide. It was attempted to include all data prior to July 31, 1974. Some of the older data were omitted or referenced as "other measurements." (auth)

12908 NUCLEAR DATA SHEETS FOR A = 178. Greenwood, L. R. (Northwestern Univ., Evanston, IL). Nucl. Data Sheets; 13: No. 4, 549-606(Dec 1974).

The 1965 version of the Nuclear Data Sheets was revised according to experimental data received prior to March 1974; approximately 100 papers are included. Data are presented for 11 nuclei (Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, and Hg). Only alpha-decay data are available for Pt, Au, and Hg. No excited states or gamma transitions are definitely known in Yb, Ta, Re, Ir, Pt, Au, or Hg. Tentative decay schemes are proposed for Yb and Ir, the latter being first proposed in this work. Only 4 levels (J^π) are known in Lu from Yb decay. The Lu (28.4-m and 22.7-m) decay schemes are well established and closely resemble those for Ta (9.31-m and 2.2-h) decay. These decays are compared to ^{177}Hf(n,γ) studies, and new levels and transitions are proposed for all three sources of data. The Hf level scheme thus includes about 72 levels (52 J^π assignments) and about 72 gamma multipolarities. The W level scheme is due to Re decay (13.2-m), (p,xnγ), and (a,xnγ) data and includes 33 levels with 16 J^π assignments. The Os level scheme is due to the proposed Ir decay scheme and (HI,xnγ) data and includes 16 levels with 9 J^π assignments. The most important deficiency in the data is that no charged-particle reaction data are available except for Hf, where only (p,t) and preliminary (d,p) and (d,t) data have been reported. Such data would be especially useful in establishing the ordering of the ground-state and isomeric level in Ta. Suggested reactions are ^{177}Hf(^{3}He,d)^{178}Ta, (Q = −0.56 MeV); ^{180}Ta(p,t)^{178}Ta, (Q = −5.99 MeV); ^{176}Hf(^{3}He,p)^{178}Ta, (Q = +3.59 MeV); ^{178}Hf(^{3}He,t)^{178}Ta, (Q = −1.93 MeV); ^{179}Hf(d,^{3}He)^{178}Lu, (Q = −2.08 MeV); ^{176}Lu(t,p)^{178}Lu, (Q = +4.46 MeV); ^{176}Yb(^{3}He,p)^{178}Lu, (Q = +4.33 MeV); ^{176}Yb(t,p)^{178}Yb, (Q ≈ +3.65 MeV); and ^{180}W(p,t)^{178}W, (Q = −6.89 MeV). (auth)

12909 ODD PROTON STATES IN ^{165}Tm, ^{167}Tm, ^{169}Tm, AND ^{171}Tm. Cheung, H. C.; Burke, D. G.; Loevhoeiden, G. (McMaster Univ., Hamilton, Ont.). Can. J. Phys.; 52: No. 21, 2108-2126 (1 Nov 1974).

Proton states in the odd mass isotopes ^{165}Tm, ^{167}Tm, ^{169}Tm, and ^{171}Tm were studied using (^{3}He,d) and (α,t) reactions with 24 ^{3}He and 27-MeV ^{4}He beams. The reaction products were analyzed with a magnetic spectrograph and detected with photographic emulsions, giving a resolution (FWHM) of 16 to 18 keV. The proton transfer l values were determined from (^{3}He,d) angular distributions and from the ratios of (^{3}He,d) and (α,t) cross sections. Nuclear structure factors, extracted using DWBA cross sections, were compared to those predicted by the Nilsson model with pairing corrections and Coriolis coupling included. Most of the previous assignments for low lying proton states were confirmed, and several new ones were made. It is shown that the energy systematics of the intrinsic proton states cannot be attributed to variations in the quadrupole deformation, ϵ_2, but can be explained by a small monotonic variation in the hexadecapole deformation, ϵ_4. (auth)

12910 DOMINANCE OF THE $i_{13/2}$ NEUTRON IN Yb BACKBENDING. Riedinger, L.L. (University of Tennessee, Knoxville, Tennessee 37916); Smith, G.J.; Stelson, P.H.; Eichler, E.; Hagemann, G.B.; Hensley, D.C.; Johnson, N.R.; Robinson, R.L.; Sayer, R.O. Phys. Rev. Lett. 33: No. 22, 1346-1349 (25 Nov 1974).

Two decoupled rotational bands in ^{165}Yb are observed in (heavy ion, xn) experiments. The $i_{13/2}$ band does not backbend, whereas the $h_{9/2}$ band does. This provides strong evidence that only $i_{13/2}$ neutrons contribute to backbending in this region. (auth)

12911 GAMMA TRANSFERS OF DECOMPOSITION OF Yb^{169}-Tm^{169} WITH AN ENERGY EXCEEDING 300 keV. Georgieva, M. K.; Misheva, M. A.; Tumbev, G. Kh. (Bylgarska Akademiya na Naukite, Sofia. Fizicheski Inst.). Compt. Rend. Acad. Bulg. Sci.; 26: No. 5, 623-626(1973).

In recent classifications, a ^{169}Yb−^{169}Tm mass difference is given in the interval 1000 to 1200 keV, a value significantly different from earlier values (400 to 600 keV). This indicates a population of decay levels above 472 keV, which is considered the most populated level, and an attempt was made to verify their existence experimentally. Results of Dzhelepov et al. from study of internal conversion electrons and gamma rays with energies greater than 300 keV indicate the existence of transitions with levels of 571.0, 633.08, 718.0, 781.5, and 825.2 keV. In the present work the ^{169}Yb → ^{169}Tm decay spectrum was studied above 300 keV with a 10 cm^3 Ge(Li) detector having a 2.8-keV resolution on ^{60}Co. Sources were obtained by the reaction ^{168}Yb(n, γ)^{169}Yb reaction. Measurements were made 2 to 5 months after irradiation with sources 62, 17, 4, and 2 cm from the detector. The ratio of "useful information" to background was on one order of magnitude higher than in the quoted work, and the resolving power of the spectrometer was significantly better. A peak corresponding to the 336.6-keV transition was obtained with the expected half-width and not resolved (as in the quoted work). The data do not indicate transitions with energies of 465.0, 474.5, 633.03, 642.6, 686.3, or 710 keV. The 562.4- and 569.8-keV transitions are weak. Other results differ little from the quoted data. (INIS)

12912 ROTATIONAL BANDS IN THE "SPHERICAL" NUCLEUS ^{151}Sm. Burke, D.; Cork, B.; Johns, M.; Loevhoeiden, G.; Smith, A.; Waddington, G. (McMaster Univ., Hamilton, Ont.). Nukleonika; 19: No. 7-8, 649-653(1974).

The following reactions leading to states in ^{151}Sm have been studied: (^{3}He, α), (d, t), (d, p), (α, 3n), (α, α′), (^{16}O, ^{16}O′), and ^{150}Nd(n, γ) ^{151}Nd $\xrightarrow{\beta^-}$ ^{151}Pm $\xrightarrow{\beta^-}$ ^{151}Sm. Evidence is discussed for the existence of rotational bands in ^{151}Sm. The analysis of these bands shows clearly that, at moderate levels of excitation, ^{151}Sm reveals many of the properties of strongly deformed nuclei. (5 figures) (auth)

12913 SPIN−SPIN NUCLEAR FORCES AND THE BETA DECAY ^{161}Tb → ^{161}Dy. Bogdan, D. (Inst. of Atomic Physics, Bucharest); Cretu, T.; Macarie, G. Rev. Roum. Phys.; 19: No. 5, 525-532(1974).

The ft values for the ^{161}Tb → ^{161}Dy transitions were calculated using the spin polarization effects of the core. For the allowed hindered transitions with ΔN = 2, the Coriolis forces in the final states are also considered. An important improvement of the theoretical results is achieved. (auth)

12914 NONEQUILIBRIUM BETA PROCESSES AND THE ROLE OF EXCITED NUCLEAR STATES. Bisnovatyi-Kogan, G. S.; Rudzskii, M. A.; Seidov, Z. F. (Inst. of Mathematical Problems, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1621-1630(Nov 1974). (In Russian).

Electron capture by heavy nuclei is calculated on basis of the gas model of the nucleus by taking into account excited states of the final nucleus. Results of experiments on muon capture by nuclei in mesoatoms are used for determining the value of the matrix element. The cross section for neutrino capture by heavy nuclei is calculated within the framework of the same model, and it is demonstrated that with a large probability capture of neutrinos with energies $E_\nu \gtrsim 30$ MeV should involve ejection of the neutron from the excited nucleus. This fact may be important for recording neutrinos. (auth)

12915 DECAY OF ^{173}Hf AND MEASUREMENT OF THE HALF-LIFE OF THE 128.3-keV STATE IN ^{173}Lu. Funk, E.G.; Zolnowski, D.R.; Madden, M.C.; Belt, R.A.; Mihelich, J.W. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 10: No. 5, 2015-2033 (Nov 1974).

The γ-ray and internal-conversion-electron spectra associated with the decay of ^{173}Hf (23.9 h) to ^{173}Lu have been studied using Ge(Li) and Si(Li) detectors. Approximately 70 transitions have been assigned to the ^{173}Hf decay and conversion coefficients, and multipolarities have been obtained for 35 transitions. The results of γ-γ coincidence measurements confirmed the placement of many transitions previously proposed by other investigators, and were utilized in the construction of a decay scheme including about 50 transitions and several newly proposed levels. The existence of at least three transitions with significant E0 content has been established. These depopulate states in two $K^\pi = 1/2^+$ bands based at 981.7 and 1246.3 keV, which are probably octupole-vibrational and β-vibrational bands, respectively. γ-ray branching ratio data are presented, and Nilsson state assignments and possible vibrational-state assignments are discussed. The half-life of the 128.3-keV $(1/2^-)$ state in the $1/2^-[541]$ band has been measured as 5.2 ± 0.5 nsec, and the B(E2) value for the enhanced 4.8-keV rotational transition depopulating the 128.3-keV state has been deduced using theoretical predictions for the internal-conversion coefficient. (auth)

12916 COUPLED-CHANNEL CALCULATIONS OF ELECTRON SCATTERING BY SAMARIUM. Mercer, R.L. (Speech Processing Group, Computer Sciences Department, International Business Machines Corporation, Thomas J. Watson Research Center, Yorktown Heights, New York 10598); Ravenhall, D.G. Phys. Rev. C 10: No. 5, 2002-2014 (Nov 1974).

The coupled-channel method is considered in the context of relativistic hadron or lepton scattering by nonspherical dynamical nuclei. The program Zenith, which calculates electron-nucleus scattering via Coulomb and magnetic multipole potentials, is described and is applied in particular to the deformed samarium isotopes ^{152}Sm and ^{154}Sm. Two- and three-level calculations for the ground state 0+ and the excited states 2+ and 4+ containing all relevant l = 0, 2, and 4 Coulomb potentials are described. The elastic dispersion effect, arising mainly from coupling with the 2+ first excited state, and the dispersive effect on the $0+ \rightarrow 2+$ inelastic cross section, coming mainly from the diagonal l = 2 scattering in the excited state, are appreciable at 105 MeV, the highest energy at which measurements have been made. The largest effect, however, is that on the $0+ \rightarrow 4+$ inelastic cross section arising from the sequential excitation $0+ \rightarrow 2+ \rightarrow 4+$ via the l = 2 potential. It has interesting small-angle behavior and becomes greater than 20% at the largest measured angles at 105 MeV. The dependence of some of these effects on energy and q_{eff} is explored up to 250 MeV and 2 fm^{-1}. (auth)

12917 LEVELS IN ^{158}Gd POPULATED IN THE DECAY OF 46-MIN ^{158}Eu. Kluk, A.F.; Johnson, N.R. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Hamilton, J.H. Phys. Rev. C 10: No. 5, 1966-1982 (Nov 1974).

The series of investigations of level properties in even gadolinium nuclei has been extended to ^{158}Gd. γ rays emitted in the radioactive decay of ^{158}Eu were studied with large-volume Ge(Li) detectors in both singles and coincidence modes to reveal a total of 132 transitions, 94 of which were incorporated in a level scheme involving 31 excited states. Several of the level assignments clarified conflicting data in the literature, and 12 of the levels had not been observed previously. The coincidence measurements have provided reliable branching ratios for members of the γ-vibrational band and members of $K = 0^-$ and 1^- octupole bands. Analyses of the data for the octupole bands are compared with theory. In ^{154}Gd and ^{156}Gd the $K = 0^-$ octupole band lies lower than the $K = 1^-$ band, in agreement with theoretical expectations that the $K = 0^-$ component of the $\lambda = 3$ vibration is the most collective. However, in ^{158}Gd this trend is reversed and the $K = 1^-$ component is lowest. (auth)

12918 DECAY OF THE $K^\pi = 8^-$ ISOMER IN ^{182}Hf. Ward, T.E.; Haustein, P.E.; Cumming, J.B.; Chu, Y.Y. (Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. C 10: No. 5, 1983-1992 (Nov 1974).

The decay of 61.5-min ^{182}Hf^m($K^\pi = 8^-$) in chemically separated and mass-separated sources has been studied by means of Ge(Li) detectors and a plastic scintillation detector. Twenty-eight γ rays, and two β rays of 480±50 and 970±70 keV, were assigned to the decay of ^{182}Hf^m. The 480-keV β group was observed to be in coincidence with high-energy γ rays. Ge(Li) -Ge(Li) γ-γ coincidence measurements established the $K^\pi = 0^+$ ground-state rotational band of ^{182}Hf up to the I = 8 member. The energy of the isomeric state is at 1172.9 keV in ^{182}Hf. ^{182}Hf^m decays 54% by negatron emission to levels at 653, 1116, and 1337 keV in ^{182}Ta. The 653- and 1116-keV levels are identified as $K^\pi = 9^-$ and 7^- states, respectively, with possible Nilsson configurations of $9/2^-[514]_n$, $9/2^+[624]_n$, and $7/2^+[404]_p$, $7/2^-[514]_n$. The Q value for β decay of ^{182}Hf has been inferred to be 432±41 keV. (auth)

12919 LEVEL STRUCTURE OF ^{160}Gd FROM THE (n, nγ) REACTION. Elbakr, S.A.; van Heerden, I.J.; Gill, D.R.; Ahmed, N.; McDonald, W.J.; Neilson, G.C.; Dawson, W.K. (Nuclear Research Centre, The University of Alberta, Edmonton, Alberta, Canada T6G 2J1). Phys. Rev. C 10: No. 5, 1864-1871 (Nov 1974).

The energy levels of ^{160}Gd have been studied by the (n, nγ) reaction. Deexcitation γ rays were observed in a time-of-flight gated Ge(Li) detector at several neutron energies between $E_n = 1.10$ and 2.32 MeV. A level scheme for the ^{160}Gd nucleus is proposed. Previous spin and parity assignments for the 989 (2+) and 1149 (4+) keV levels were confirmed. New levels are proposed at 1058, 1351, 1378, 1381, 1436, 1569, 1587, and 1599 keV. Spin and parity assignments for previously known levels and for some new levels at 1058 (3+), 1071 (4+), 1149 (4+), 1378 (2+), 1381 (0+), and 1569 (1) keV have been determined by comparing the experimental cross sections with the predictions from the compound nuclear statistical model. A J^π assignment is proposed for the 1225 (2+), 1290 (2-), 1351 (1,2), 1464 (0+), and 1599 (0+) keV levels. (auth)

12920 NEUTRON RESONANCE SPECTROSCOPY: ^{154,158,160}Gd. Rahn, F.; Camarda, H.S.; Hacken, G.; Havens, W.W. Jr.; Liou, H.I.; Rainwater, J. (Columbia University, New York, New York 10027). Phys. Rev. C 10: No. 5, 1904-1909 (Nov 1974).

Neutron time-of-flight spectroscopy measurements were made for a range of sample thickness on the even separated Gd isotopes A = 154, 158, and 160. These include transmission measurements using 200 and 40 m flight paths and self-indication measurements using a 40 m flight path. Resonance parameters were obtained for 48 levels to 1 keV for ^{154}Gd and for 95 and 56 levels to 10 keV for ^{158}Gd and ^{160}Gd. The experimental s-wave strength functions were $10^4S_0 = (2.0 \pm 0.3)$, (1.5 ± 0.2), and (1.8 ± 0.4), respectively. For ^{160}Gd, the p strength function is $10^4S_1 \simeq 1.7 \pm 0.3$. Essentially complete s-wave populations were obtained for the first 19 levels in ^{154}Gd with $\langle D \rangle = 14.5 \pm 1.5$ eV and $\Delta_{exp} = 0.22$ (vs $\Delta_{DM} = 0.28 \pm 0.11$); 47 levels in ^{158}Gd with $\langle D \rangle = 86 \pm 4$ eV and $\Delta_{exp} = 0.29$ (vs $\Delta_{DM} = 0.38 \pm 0.11$); and 20 levels in ^{160}Gd with $\langle D \rangle = 202 \pm 20$ and $\Delta_{exp} = 0.32$ (vs $\Delta_{DM} = 0.30 \pm 0.11$). Comparison of the observed Γ_n^0 distributions with the Porter-Thomas theory and the observed level spacings with the Wigner theory and other statistical orthogonal ensemble tests gave good results for the energy intervals over which complete s populations were observed. The average radiation widths were $\langle \Gamma_\gamma \rangle = 88$ meV determined from n = 25 levels in ^{154}Gd, $\langle \Gamma_\gamma \rangle = 105$ meV (n = 27) in ^{158}Gd and $\langle \Gamma_\gamma \rangle = 111$ meV (n = 4) in ^{160}Gd. (auth)

12921 HIGH-SPIN EXCITATION MODES IN EVEN Hg NUCLEI. Proetel, D.; Diamond, R. M.; Stephens, F. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Phys., A; 231: No. 2, 301-315(14 Oct 1974).

The low lying high spin states in mercury isotopes with A = 188, 194, 196, and 198 were studied by γ-ray spectroscopy following (HI,xn) reactions, and for ^{188}Hg also by the β-decay of ^{188}Tl. A variety of modes of excitation are found. Irregularities in the energies of the positive-parity states in ^{188}Hg are interpreted as a shape transition to larger deformation similar to those recently observed in ^{186}Hg and ^{184}Hg. In the heavier Hg isotopes a small spacing between the 8+ and 10+ states (less than 100 keV) was found, and in ^{194}Hg and ^{196}Hg values of B(E2; 10+ → 8+) were determined to be considerably smaller than the B(E2; 2+ → 0+) value. The interpretation of these results as being due to a transition to a two-particle (hole) configuration, predominantly $(\pi h_{11/2}^{-2})$, is discussed. Still another type of excitation is illustrated by the negative-parity band observed up to the 11^- level in ^{194,196,198}Hg. It is most likely a combination of the collective motion of the core and of two-quasiparticle states, predominantly $[\nu i_{13/2}, \nu j]$, with some contribution of $[\pi h_{11/2}, \pi j]$. (auth)

12922 COLLECTIVE HAMILTONIAN DERIVED FROM THE PAIRING-PLUS-QUADRUPOLE MODEL. Modification and Application to the Transitional Nuclei, ^{150,152}Sm. Kumar, K. (Vanderbilt Univ., Nashville, Tenn. (USA)). Nucl. Phys., A; 231: No. 2, 189-232(14 Oct 1974).

The time-dependent Hartree-Bogolyubov treatment of the pairing-plus-quadrupole model, employed previously for the energy levels and the electromagnetic moments of W, Os and Pt nuclei, was modified and extended to higher angular momentum states. Comparison with experiment is given for the energy levels, B(E2) values, quadrupole moments, magnetic moments, electric monopole transition moments, isomer shifts, E2/M1 mixing ratios and E0/E2 mixing ratios of ^{150}Sm and ^{152}Sm. Spectroscopic factors for one-proton, one-neutron and two-neutron transfer reactions are given. Microscopic and collective explanations are given for the transition from a vibrational-type spectrum for ^{150}Sm to a rotational-type spectrum for ^{152}Sm, the co-existence of a large Q_2+ with a vibrational-type spectrum and a small cross-over B(E2) in ^{150}Sm, band-mixing anomalies in ^{152}Sm, and signs of the mixing ratios δ(E2/M1) and ϵ(E0/E2) in the two nuclei. However, the present model seems to break down in the case of the E2 branching ratios in ^{150}Sm. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 12806, 12848, 12878, 12879, 12881, 12883, 12888, 12896, 12898, 12902, 12914, 12964, and 12997.

12923 (ORO-3346-154, pp 18-24) EXCITED STATES IN ^{189,191}Au FROM DECAY OF ^{189m,g}Hg, ^{191m,g}Hg; SHAPE COEXISTENCE IN THE Au ISOTOPES; THE ^{191g}Hg GROUND STATE. Wood, J. L.; Zganjar, E. F. 31 Oct 1974.

In nuclear and x-ray spectroscopy with radioactive sources.

12924 SIMPLE (PARTICLE-EXCITATION) NUCLEAR ISOMERS AND WHAT THEY CAN TEACH US. McHarris, W. C. (Michigan State Univ., East Lansing). Accounts Chem. Res.; 7: No. 12, 401-408(Dec 1974).

A brief introduction to the nature of nuclear isomers and how they can be of use is given. The discussion is restricted to spin isomers. Equations for estimating half-lives from the single-particle model are given. The occurrence of isomers is discussed, particularly in odd–odd nuclei and nuclei below closed shells. Study of isomeric transitions can yield new information on nuclear structure. The connection between isomeric transitions and beta decay is examined. (7 figures, 1 table) (RWR)

12925 RADIUS OF THE NEUTRON DISTRIBUTION IN ^{208}Pb FROM THE (p, n) QUASIELASTIC REACTION. Friedman, E. (The Racah Institute of Physics, The Hebrew University, Jerusalem, Israel). Phys. Rev. C 10: No. 5, 2089-2092 (Nov 1974).

A microscopic analysis of the ^{208}Pb(p, n)^{208}Bi isobaric analog state (IAS) reaction is presented where the nucleon–nucleon interaction can be density dependent and the form factor for the reaction may have an imaginary term. The various ambiguities make it very difficult to obtain from this reaction accurate values for the radii of neutron distributions. Comparisons are also made with other results relating to the neutron distribution in ^{208}Pb. (auth)

12926 THE ξ-APPROXIMATION AND THE 2-(0.96 MeV β^-)2$^+$ TRANSITION IN ^{198}Au. Krmpotic, F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik); Szybisz, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Phys. Lett., B; 52: No. 2, 153-155(30 Sep 1974).

It is shown that the recent measurement of β-γ (circularly polarized) correlation in ^{198}Au performed by Hartman and Daniel is inconsistent with a great number of experiments realized previously on the 2$^-$(0.96 MeV β^-)2$^+$ transition. In addition, it is confirmed that this process is qualitatively well described by the ξ-approximation. (auth)

12927 E0 PROPERTIES IN THE LEAD REGION. Speth, J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik); Zamick, L. (Rutgers—The State Univ., New Brunswick, N. J. (USA). Dept. of Physics); Ring, P. (Technische Univ. Muenchen, Garching (F. R. Germany). Teilinstitut Theorie im Physik-Dept.). Nucl. Phys., A; 232: No. 1, 1-12 (28 Oct 1974).

The theory of finite Fermi systems is applied to monopole properties in the lead region-isotope shifts, isomer shifts, and E0 transition rates. A density-dependent delta interaction is used. It is noted that the L = 0 properties are much more sensitive to the density dependence than are the other properties such as M1 and E2 transitions. (auth)

12928 EXCITATION OF TWO-PARTICLE-ONE-HOLE STATES BY THE ^{208}Pb(d,p)^{209}Pb REACTION. Kovar, D. G.; Stein, N.; Bockelman, C. K. (Yale Univ., New Haven, Conn. (USA). Nuclear Structure Lab.). Nucl. Phys., A; 231: No. 2, 266-300(14 Oct 1974).

The weak transitions in the ^{208}Pb(d,p)^{209}Pb reaction leading to two-particle–one-hole (2p-1h) states in ^{209}Pb were studied at a bombarding energy of 20 MeV. These transfers exhibit typical stripping-type angular distributions and were analyzed using standard DWBA for l-values and spectroscopic factors. Arguments are presented which support an interpretation of these results as one-step transfer reactions proceeding in some cases via single-particle admixtures in the final states and in other cases via 2p-2h correlations in the ^{208}Pb ground state. The results imply a departure of ^{208}Pb from shell closure in qualitative agreement with the magnitude and character predicted by RPA calculations. Four fragments which exhaust most of the available $j^{15}/_2$ single-particle strength are observed. Evidence is also obtained for fragments of single-particle strength from the N > 184 shell mixed into low lying states of primary 2p-1h configuration. The observed levels are compared with the ^{209}Pb level structure predicted by calculations based on a hole coupled to the multipole pairing states in ^{210}Pb and a particle coupled to particle-hole excitations in ^{208}Pb. (auth)

12929 FISSION OF GOLD INDUCED BY A COHERENT PHOTON BEAM FROM 1 GeV ELECTRONS. Bologna, G. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati); Emma, V.; Figuera, A. S.; Lo Nigro, S.; Milone, C. (Catania Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 52: No. 2, 192-194(30 Sep 1974).

Fission measurements on Au were performed by means of a coherent bremsstrahlung photon beam from 1-GeV electrons. The photofission cross section deduced from the experimental yields by an unfolding method shows a resonance at photon energy 320 MeV. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 11960–11963, 12806, 12823, 12878, 12881, 12902, 12903, 12914, and 12964.

12930 (AERE-PR/NP-21) NUCLEAR PHYSICS DIVISION PROGRESS REPORT FOR THE PERIOD 1ST APRIL 1973 TO 31ST MARCH 1974. Blair, I. M.; Conlon, T. W. (eds.). (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Aug 1974. 105p. Dep. NTIS (U. S. Sales Only) $8.25.

The report is presented under the following heads: nuclear data for reactors, nuclear studies, interdisciplinary research (including Mössbauer studies); miscellaneous techniques (including ion implantation, ion probes, use of proton beams); radioisotope and industrial physics; accelerator operation, maintenance and development; reports, publications and conference papers. (UK)

For title listings of selected papers see: 12787, 12817, 12818, 12876, 12900, 12931, and 12932.

12931 (AERE-PR/NP-21, pp 8-9) ^{238}U/^{235}U FISSION CROSS-SECTION RATIO. Coates, M. S.; Gayther, D. B.; Pattenden, N. J. Aug 1974.

12932 (AERE-PR/NP-21, pp 15-19) INTERMEDIATE STRUCTURE STUDIES OF ^{234}U CROSS SECTIONS. James, G. D.; Dabbs, J. W. T.; Harvey, J. A.; Hill, N. W.; Schindler, R. (Oak Ridge National Lab., TN). Aug 1974.

12933 (CEA-R-4626) MEASUREMENT OF $\bar{\nu}_p$, THE AVERAGE NUMBER OF PROMPT NEUTRONS EMITTED IN THE FISSION OF ^{240}Pu AND ^{241}Pu INDUCED BY NEUTRONS IN THE ENERGY RANGE 1.5 to 15 MeV. Frehaut, J.; Mosinski, G.; Bois, R.; Soleilhac, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1974. 25p. (In French). Dep. NTIS (US Sales Only) $4.25.

A precise measurement (1.5% relative value) of the average number $\bar{\nu}_p$ of prompt neutrons emitted in the fission of ^{240}Pu and ^{241}Pu induced by neutrons in the energy range from 1.5 to 15 MeV was carried out separately for these two nuclei. For both measurements, the 12-MeV Van de Graaff tandem accelerator of C. E. Bruyères-le-Châtel was used as a pulsed neutron source. The technique for the detection of fission neutrons made use of a fission chamber associated with a large volume Gd-loaded liquid scintillator. For the $\bar{\nu}_p$ measurement of ^{240}Pu, deposits of ^{235}U were also placed in the fission chamber in order to obtain the ratio of the fission cross sections of ^{240}Pu and ^{235}U, for which the data are very scarce in this energy range. A precise value of $\bar{\nu}_p$ for the spontaneous fission of ^{240}Pu was also obtained ($\bar{\nu}_p$ = 2.148 ± 0.015). (6 figures, 5 tables) (auth)

12934 (GSI-tr-74/3) EXPERIMENTS FOR THE SYNTHESIS OF SUPERHEAVY NUCLEI IN REACTIONS WITH GERMANIUM IONS. Flerov, G. N.; Oganesyan, Yu. T.; Lobanov, Yu. V.; Pleve,

A. A.; Ter-Akop'yan, G. M.; Demin, A. G.; Tret'yakova, S. P.; Chepigin, V. I.; Tret'yakov, Y. P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F.R. Germany)). Jan 1974. 13p. (In German). INIS.

3 figs.; 1 tab.; 21 refs. With abstract. Translated from JINR-P-7-7409. Published in Yader. Fiz.

Experiments for the synthesis of superheavy nuclei by irradiation of ^{232}Th and ^{238}U with ^{74}Ge, ^{76}Ge ion which were accelerated in the cyclotron tandem of the JINR are described. The experimental method permits the detection of the spontaneous fission of isotopes with half-lives of between 5 msec and 1 year. The upper limit for the generation of superheavy nuclei in the reactions ^{232}Th + ^{74}Ge, ^{76}Ge) is 10^{-34} cm^2. The question of which factors determine the formation cross-section of superheavy nuclei in such reactions is discussed. (auth)

12935 (IA-1301) NEUTRON CROSS SECTIONS FOR PLUTONIUM-238. Caner, M.; Yiftah, S. (Israel Atomic Energy Commission, Tel Aviv). Jul 1974. 59p. Dep. NTIS (US Sales Only) $6.00.

An evaluation of ^{238}Pu neutron data was performed. All significant cross sections in the neutron energy range 10^{-3} to 15×10^6 eV were considered. The experimental data were complemented by spherical optical model and statistical theory calculations and by systematics. The evaluated data were compared with those in the ENDF/B-III file. (auth)

12936 (INDC(CCP)-38/U) NUCLEAR CONSTANTS, NO. 8. Part 1. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Jul 1974. Translated from Russian. 179p. Dep. NTIS (US Sales Only) $12.00.

Separate abstracts were prepared for each of the six papers in this report. (RWR)

For abstracts of individual papers see: 12752, 12842, 12878, and 12937–12939.

12937 (INDC(CCP)-38/U, pp 9-35) EVALUATION OF URANIUM-238 FISSION CROSS SECTIONS. Nikolaev, M. N. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

Differences in previous evaluations of the ^{238}U fission cross section suggested still another evaluation. A survey (with tables) of the data used in the evaluation is given; age of the measurement and amount of detail given by experimenters were used in assigning weights to the various measurements. The ranges 2 to 5.5 MeV, below 2 MeV, and above 5.5 MeV are discussed separately. The average cross section in a fission spectrum was also examined. (5 figures, 19 tables) (RWR)

12938 (INDC(CCP)-38/U, pp 121-156) EVALUATION OF MEAN RESONANCE PARAMETERS FOR URANIUM-238. Abagyan, L. P.; Korchagina, Zh. A.; Nikolaev, M. N.; Nesterova, K. I. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

Calculation of average group characteristics in the unresolved resonance range from the mean statistical parameters of the cross-section resonance structure is discussed generally at first. The goal of this work is the determination of mean parameters for ^{238}U from data on the resolved resonances, and then the calculation of average cross sections and their comparison with experimental values. The procedure is discussed under the following headings: initial data, determining the mean level spacing, evaluation of mean neutron widths and strength functions, evaluation of the mean radiation width, and calculation of ^{238}U cross sections from the mean resonance parameters. (9 figures, 4 tables) (RWR)

12939 (INDC(CCP)-38/U, pp 157-179) EFFECT OF THE MAGNITUDE OF MEAN RESONANCE PARAMETERS ON GROUP CROSS SECTIONS FOR URANIUM-238. Abagyan, L. P.; Nikolaev, M. N.; Nesterova, K. I.; Orlov, M. Yu.; Petrova, L. V. Jul 1974. Translated from Russian.

In nuclear constants, No. 8. Part 1.

The effect of the magnitude of the mean resonance parameters of ^{238}U on the group cross sections, calculated with allowance for homogeneous resonance self-shielding, is studied. The first derivatives of the average capture, scattering, and transport cross sections are calculated for ^{238}U (present in a medium in various concentrations) from different mean resonance parameters. The cross sections were calculated in the energy range from 0.465 to 200 keV for resonances either entirely unresolved or only partially resolved. Contributions from s and p waves were taken into account; above 20 keV, d waves were also included. The work is presented under the headings Initial data and method of calculation, Notes on the method of calculation, and Calculation results. The results are given in two tables and twelve figures, the latter showing the energy dependence of cross sections and of first derivatives for different dilution cross sections. (13 figures, 3 tables) (RWR)

12940 (INDC(CCP)-42/U) NUCLEAR CONSTANTS, NO. 9. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Aug 1974. Translated from Russian. 95p. Dep. NTIS (U. S. Sales Only) $7.75.

Separate abstracts were prepared for five of the items in this report. The remaining two have appeared in NSA as abstracts 29: 03771 and 29: 04009. (RWR)

For abstracts of individual papers see: 12843, 12879, 12941, 12942, and 12966.

12941 (INDC(CCP)-42/U, pp 1-2) RE-EVALUATED NUCLEAR CONSTANTS FOR THE ENERGY 0.0253 eV. Morogovsky, G. B. Aug 1974. Translated from Russian.

In nuclear constants, No. 9.

Two programs for processing nuclear data were written in FORTRAN to run on a Minsk-22 computer. The first program was designed for obtaining recommended values of the standard parameters σ_f, σ_a, σ_γ, η, ν, and α for a fissionable nucleus; the second, for calculating standard values for the four nuclei ^{233}U, ^{235}U, ^{239}Pu, and ^{252}Cf simultaneously using the correlations between them. The results of the calculations are tabulated. (2 tables) (RWR)

12942 (INDC(CCP)-42/U, pp 7-9) RELATIVE YIELDS OF DELAYED NEUTRONS FROM URANIUM-238 FISSION BY NEUTRONS WITH ENERGIES IN THE RANGE 3.9 TO 5.1 MeV. Maksyutenko, B. P.; Balakshev, Yu. P.; Volkova, G. I. Aug 1974. Translated from Russian.

In nuclear constants, No. 9.

A metallic sample was irradiated for 300 seconds. The relative yields of groups of delayed neutrons are tabulated with the mean-square errors obtained from the scatter of the curves for two series of measurements. The variation in the ratio of the group yields with changes in the neutron energy is shown. The variations exceed the experimental errors. (1 figure, 1 table) (RWR)

12943 (JINR-P7-8042) SEARCH FOR SUPERHEAVY ELEMENTS IN METEORITES. Popeko, A. G.; Skobelev, N. K.; Ter-Akop'yan, G. M.; Goncharov, G. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Measurements of neutron emission from the Saratov, Efremovka and Allende meteorites were performed by using neutron multiplicity detectors. An activity exceeding the background due to spontaneous fission of uranium was recorded. The possible relationship of the activity observed to both spontaneous fission of superheavy elements and anomalies in the content of heavy Xe isotopes in meteorites is discussed. (7 figures, 2 tables) (auth)

12944 (UCID-16136) STATUS REPORT TO USNDC. Browne, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Oct 1972. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

This report contains information on studies in nuclear physics including neutron multiplicities, gamma emission preceding isomeric fission, and capture cross sections. Two papers, containing significant amounts of cross-section information, are title listed separately. (RWR)

For title listings of individual papers see: 12844 and 12883.

12945 NEUTRON TOTAL CROSS SECTION OF CURIUM-248. Benjamin, R. W. (Savannah River Lab., Aiken, SC); Ahlfeld, C. E.; Harvey, J. A.; Hill, N. W. Nucl. Sci. Eng.; 55: No. 4, 440-449(Dec 1974).

The neutron total cross section for ^{248}Cm was measured from 0.5 to 3000 eV by using the Oak Ridge electron linear accelerator (ORELA) as a pulsed neutron source. The cylindrical samples of small diameter (1.6 to 4.0 mm) contained up to 13 mg of 97% ^{248}Cm and 3% ^{246}Cm in the oxide form. Samples were cooled with liquid nitrogen to reduce Doppler broadening. The thickest sample had an inverse thickness for curium isotopes of 624 b/atom, which made possible the identification of forty-seven resonances attributable to ^{248}Cm and five resonances attributable to ^{246}Cm. The cross-section data were analyzed to obtain single-level Breit–Wigner resonance parameters for all observed resonances. An average level spacing of 40 ± 5 eV and an average s-wave neutron strength function of $(1.2 \pm 0.2) \times 10^{-4}$ were determined for ^{248}Cm. The resonance contributions to the thermal capture cross sections and the resonance integrals determined from the resonance parameters are ^{248}Cm, $\sigma_{n\gamma}^{2200} = 2.51 \pm 0.26$ b, $I_{n\gamma} = 259 \pm 12$ b; ^{246}Cm, $\sigma_{n\gamma}^{2200} = 1.2 \pm 0.4$ b, $I_{n\gamma} = 101 \pm 11$ b. These values compare well with the results of integral measurements. (8 figures, 7 tables) (auth)

12946 CROSS SECTIONS OF URANIUM-235 AND PLUTONIUM-239 FOR NEUTRONS PRODUCING GAMMA RAYS. Drake, D. M.

(Los Alamos Scientific Lab., NM). Nucl. Sci. Eng.; 55: No. 4, 427-439(Dec 1974).

Gamma-ray spectra were measured for 1- and 2-MeV neutron interactions with ^{235}U and ^{239}Pu and for 5- and 8-MeV neutron interactions with ^{235}U by using a time-of-flight technique and an anti-Compton spectrometer. Gamma-ray production cross sections were determined and compared with previous measurements. (15 figures, 3 tables) (auth)

12947 TEMPERATURE-DEPENDENT AND MULTI-LEVEL EFFECTS ON NEUTRON RESONANCE CROSS SECTIONS. Shea, T. E. Troy, NY; Rensselaer Polytechnic Inst. (1974). 254p. University Microfilms Order No. 74-26,094.

Thesis (Ph. D.).

The effects of temperature-dependence and multi-level interference on neutron resonance cross sections and their manifestations on cross section-dependent quantities are examined through the application of the Quasi-Resonance Multi-Level cross section formalism. The Quasi-Resonance Triplet Approximation is introduced to facilitate the application of the formalism to the fissile nuclides. The Triplet Approximation fission parameters are studied in detail. For ^{235}U, they are determined to be negligibly intercorrelated. The average symmetric fission parameter and its corresponding chi-square number of degrees of freedom are seen to be energy-dependent. The Triplet Approximation is applied to the calculation of the ^{235}U fission cross section in the range from 18 to 66 eV. The Approximation gives an improved representation of the cross section line shape. Fission integrals as well as pointwise cross sections are compared with experiment. The average capture and fission cross sections and the average alpha for ^{235}U are computed in the energy range below 2.5 keV. The Triplet Approximation is applied to the Bramblett-Czirr experiment on shielded fission integrals for ^{235}U, in the resolved and unresolved resonance regions. The results indicate a need for additional cross section measurements. (RWR)

12948 INTEGRAL FISSION CROSS SECTIONS DETERMINED IN A ^{252}Cf FISSION NEUTRON SPECTRUM. Chromik, J. J. Austin, TX; Univ. of Texas, Austin (1974). 195p. University Microfilms Order No. 74-24,841.

Thesis (Ph. D.).

Integral fission-spectrum-averaged cross sections given by $\bar{\sigma}_f = \int_0^\infty \sigma_f(E)\phi(E)dE / \int_0^\infty \phi(E)dE$ for ^{232}Th, ^{233}U, ^{235}U, ^{236}U, ^{238}U, ^{237}Np, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am, and ^{243}Am were measured in a neutron fission spectrum from a nominal one-milligram ^{252}Cf source. Sixteen samples of the eleven fissionable nuclides in the form of thin deposits or pellets were irradiated in a large evacuated area for time sufficiently long to accumulate approximately 10^5 fission fragments/cm^2. Fission events were detected by using solid state track recorders, chemical etching, and optical counting. The measured integral fission cross sections were compared to analytical calculations by using differential fission cross section data presented in the literature and known neutron fission spectra. Integral fission-spectrum-averaged cross sections were determined with measured ^{252}Cf neutron spectra and several analytical fission forms by a computer code, SAND II. Corrections to the calculated fission cross sections due to the source encapsulation were determined by a one-dimensional discrete-ordinate transport theory computer code, ANISN. (Diss. Abstr. Int., B)

12949 RECOIL RANGES AND MASS YIELDS IN THE REACTOR NEUTRON INDUCED FISSION OF ^{232}U. Manobar, S. B.; Prasanna Venkatesan, P.; Prakash, S.; Ramaniah, M. V. (Bhabha Atomic Research Centre, Bombay). pp 183-190 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Preliminary work on the two important aspects of ^{232}U fission, viz., mass and kinetic energy distributions, is described. The thin target, thin catcher technique was employed in these investigations. The activities of the fission products formed were estimated by gamma-ray counting using a Ge(Li) detector. The comparison method was used for mass yield determinations. The work reported here is limited to the high-yield asymmetric region only. (1 figure, 2 tables) (auth)

12950 FISSION YIELDS IN THE THERMAL NEUTRON FISSION OF PLUTONIUM-241. Chitambar, S. A.; Jain, H. C.; Kavimandan, V. D.; Mathews, C. K. (Bhabha Atomic Research Centre, Bombay). pp 191-194 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

Fission yields must be known accurately in order to measure burn-up using fission product monitors. While extensive measurements have been made on ^{235}U and ^{239}Pu, the same is not true of ^{241}Pu. Work was, therefore, initiated with a view to measuring accurately the yields in the thermal neutron fission of ^{241}Pu, high-resolution gamma-ray spectrometry and mass spectrometry were used as the major tools. Thin, electrodeposited targets of ^{241}Pu and ^{235}U were simultaneously irradiated with neutrons, and the recoiling fission fragments were collected in super pure aluminium foils. From an analysis of the gamma-ray spectra of fission products in the catcher foils taken by a Ge(Li) detector, the yields for twelve nuclides in the thermal-neutron fission of ^{241}Pu were determined relative to ^{235}U. These yields are compared with available data on ^{241}Pu thermal-neutron fission. (1 table) (auth)

12951 RECOIL RANGES AND KINETIC ENERGY DISTRIBUTION IN THE THERMAL NEUTRON FISSION OF ^{245}Cm. Ramaswami, A.; Dangs, S. P.; Prakash, S.; Ramaniah, M. V. (Bhabha Atomic Research Centre, Bombay). pp 195-200 of Proceedings of the Chemistry Symposium. Vol. I. Bombay; Dept. of Atomic Energy (1972).

From chemistry symposium; Aligarh, India (21 Dec 1972). See CONF-721239-P1.

The excellent resolution of gamma rays with a Ge(Li) detector is used to determine recoil ranges by direct gamma counting of fission products from thermal-neutron fission of ^{245}Cm. Thin electroplated targets were irradiated with thermal neutrons, and the recoiling fission fragments were collected in superpure aluminium catcher foils. Recoil ranges of fission products falling in the asymmetric mass region were determined by gamma spectrometric analysis of the catcher foils. Few preliminary range values of fission products in the symmetric mass region were determined radiochemically. Kinetic energies of the fission fragments were calculated from ranges, and the kinetic energy deficit was estimated. (2 figures, 1 table) (auth)

12952 SPARK SPECTRUM HYPERFINE STRUCTURE, MAGNETIC, AND QUADRUPOLE MOMENTS OF ^{229}Th. Gerstenkorn, S. (Centre National de la Recherche Scientifique, Orsay, France); Luc, P.; Verges, J.; Englekemeir, D. W.; Gindler, J. E.; Tomkins, F. S. J. Phys. (Paris); 35: No. 6, 483-495(Jun 1974). (In French).

A high resolution study of the thorium 229 isotope, in the spectral range of 1 to 3μ, was made by means of Fourier spectroscopy. The configuration mixing was determined for the even (ds^2, d^2s, d^5) and odd (fd^2, fds, fs^2) configurations and the electronic hyperfine constants a_{7s}, a_{6d}, b_{6d}, a_{5f} and b_{5f} were calculated for the appropriate two groups of configurations. The experimental data are the hyperfine constants A and B from twenty levels. The value of the magnetic moment is $\mu(229) = (+0.45 \pm 0.04)\ \mu(N)$ and an approximate value is obtained for the quadrupole moment ($Q(229) = +4.3$ barns $\pm$ 20%). (auth)

12953 γ-MODE AT SCISSION. Schultheis, H.; Schultheis, R. (Univ., Munich). Nukleonika; 19: No. 7-8, 645-648(1974).

The influence of deviations from axial symmetry on the potential energy at scission was studied for triaxial ellipsoids. It was found that axial asymmetry and mass asymmetry are strongly correlated. Nonaxial deformations in necked-in nuclei should be described by two independent parameters, one for each fragment. (3 figures) (auth)

12954 RADIATSIONNYE KHARAKTERISTIKI PRODUKTOV DELENIYA. Spravochnik. (Radiation Characteristics of Fission Products. A Handbook). Gusev, N. G.; Rubtsov, P. M.; Kovalenko, V. V.; Kolobashkin, V. M. M. Moscow; Atomizdat (1974). 224p.

The principal radiation characteristics of fission products formed in nuclear reactors during prompt fission, independent and cumulative yields, total and differential activity and γ equivalents of fission products and their mixtures, energy release in rate units, and dose and energy effective spectral composition of γ radiation, were compiled and presented in graphic and tabular form. The radiation characteristics were calculated for the most common forms of fission with consideration of the operating time in reactors and storage after irradiation or prompt fission. (15 figures, 499 tables) (tr-auth)

12955 AVERAGE NUMBER OF NEUTRONS EMITTED IN THE SPONTANEOUS FISSION OF ^{244}Cm, ^{246}Cm, ^{248}Cm. Golushko, V. V.; Zhuravlev, K. D.; Zamyatnin, Yu. S.; Kroshkin, N. I.; Nefedov, V. N. Sov. At. Energy (Engl. Transl.); 34: No. 2, 178-179(Feb 1973).

Translated from At. Energ. (USSR); 34: No. 2, 135-136(Feb 1973).

Fission neutrons were detected by 48 proportional counters placed in a paraffin moderator; to reduce background, the neutron detector was placed inside a boron carbide shield. Fission fragments were recorded by using a gas-type scintillation detector. Corrections to the raw data are explained. The results obtained,

2.680 ± 0.027, 2.927 ± 0.027, and 3.173 ± 0.022 for ^{244}Cm, ^{246}Cm, and ^{248}Cm, respectively, indicated that $\mathbb{P}_p$ for even Cm isotopes increases linearly with A. (2 tables) (RWR)

12956 ELEMENT 106. Ghiorso, A.; Nitschke, J.M.; Alonso, J.R.; Alonso, C.T.; Nurmia, M.; Seaborg, G.T. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Hulet, E.K.; Lougheed, R.W. Phys. Rev. Lett. 33: No. 25, 1490-1493 (16 Dec 1974).

We have produced element 106 by bombarding ^{249}Cf with ^{18}O ions accelerated by the SuperHILAC. The new nuclide ^{263}106, produced by the (^{18}O, 4n) reaction, is shown to decay by α emission with a half-life of 0.9±0.2 sec and a principal α energy of 9.06±0.04 MeV to the known nuclide ^{259}Rf, which in turn is shown to decay to the known nuclide ^{255}No. (auth)

12957 TRANSFER AND COMPOUND-NUCLEUS REACTIONS THAT LEAD TO THE NUCLEI ^{245}Cf AND ^{244}Cf: INTERACTIONS OF ^{12}C WITH ^{239}Pu AND ^{238}U. Hahn, R.L.; Dittner, P.F.; Toth, K.S.; Keller, O.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 10: No. 5, 1889-1903 (Nov 1974).

The nuclear reactions ^{239}Pu(^{12}C, α2n-α3n) and ^{238}U(^{12}C, 5n-6n) leading to the same radioactive products ^{245}Cf and ^{244}Cf have been studied by measuring excitation functions and recoil range and angular distributions. As expected, the U + C data are consistent with predictions for complete-fusion (CF) reactions; for example, the range distributions are Gaussian with mean values that increase with increasing bombardment energy, and the angular distributions are forward peaked in the laboratory system. The results for the Pu + C reactions differ markedly from those for U + C. The range distributions are asymmetric, with high energy tails, and have centroids that decrease monotonically with increasing ^{12}C energy, from 1.6 times the expected CF value at 67 MeV to 0.6 of the CF value at 97 MeV; the angular distributions are characterized by a maximum at ~ 17° (lab) at energies well above the Coulomb barrier. The cross sections for the Pu(C, α2n and α3n) reactions are much larger than those of the Pu(C, 2n to 4n) reactions, also indicating that noncompound processes are involved in the production of the Cf nuclides, since evaporation of charged particles is expected to be negligible in such heavy nuclei. All of these results for the (C, αxn) reactions are consistent with models of transfer reactions in which an aggregate is transferred from the projectile to the target nucleus, followed by evaporation of neutrons from the resulting heavy nucleus. In particular, the average energies and angles are reproduced reasonably well by models that consider the kinematics of the transfer process. (auth)

12958 INDEPENDENT FISSION YIELDS OF Rb AND Cs FROM ^{238}U INDUCED BY FISSION-SPECTRUM NEUTRONS. Balestrini, S.J.; Forman, L. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544). Phys. Rev. C 10: No. 5, 1872-1879 (Nov 1974).

The relative independent yields of Rb and Cs from ^{238}U fission induced by fission-spectrum neutrons have been determined by means of a mass spectrograph on line with a nuclear burst reactor. The spectrograph ion source is a tantalum oven containing a target of high purity ^{238}U in a graphite matrix. After irradiation, the radioactive fission products are deposited on the focal plane of the spectrograph and each mass position is analyzed quantitatively from its β activities. Independent yields were calculated by normalizing the measurements using chain yield values and fractional independent yields that were calculated from recently measured cumulative yields for Kr and Xe. The results indicate a charge deviation from an unchanged charge distribution of 0.41 ± 0.07 nuclear charge units, a scaling factor of 1.27 for the number of neutrons associated with ^{238}U fission over the prompt number from thermal-neutron fission of ^{235}U for these fission products, and values of σ for the isobaric charge distribution of 0.49 ± 0.04 and 0.60 ± 0.02 for Rb and Cs, respectively. An odd-even Z effect is noticeable in that the fractional independent yields are generally lower by 20% ± 10% for both Rb and Cs than the mean values estimated from a smooth theoretical model. The sum of the estimated independent yields for the Rb isotopes agrees within error with that for the isotopes of the complementary element Cs. (auth)

12959 FISSION OF ODD-A AND DOUBLY ODD ACTINIDE NUCLEI INDUCED BY DIRECT REACTIONS. Back, B.B.; Britt, H.C.; Hansen, O.; Leroux, B. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87544); Garrett, J.D. Phys. Rev. C 10: No. 5, 1948-1965 (Nov 1974).

Fission probability distributions have been measured using (d, pf), (t, pf), (^{3}He, df), (^{3}He, αf), and (t, αf) reactions to excite a variety of odd-A and odd-odd actinide nuclei. Fission of the residual nuclei ^{229,231}Th, ^{231,232,233}Pa, ^{234,235,236,237,238,239}Np, ^{241}Pu, ^{240,241,243,245,247}Am, ^{249}Cm, and ^{249}Bk was studied. These results and other data available from previous (d, pf), (t, pf), and (n, f) studies are analyzed with a statistical model to obtain estimates of the heights and curvatures of one or both peaks of the double-humped fission barrier. Estimates of barrier parameters are obtained for the above nuclei and for ^{237}Th, ^{235,237,239}U, ^{239,243,245}Pu, ^{243,244}Am, ^{245,247}Cm, and ^{253}Cf. Systematic variations of the barrier parameters are discussed. (auth)

Nuclear Theory

Refer also to abstracts 12480, 12635, 12687, 12703, 12780, 12875, and 12916.

12960 (AED-CONF-74-042-008) GAMMA SPECTROSCOPY IN COMPOUND-NUCLEUS REACTIONS WITH HEAVY IONS. Lieb, K. P. (Koeln Univ. (F. R. Germany). Inst. fuer Kernphysik). 1974. 9p. (In German). INIS.

From spring meeting of the expert committee on nuclear and high-energy physics of the Deutsche Physikalische Gesellschaft e.V.; Bochum, F.R. Germany (4 Mar 1974).

12 figs. Available from ZAED.

The varyingly strong increase of the γ-intensities with beam injection energy can be used for spin assignment if the spin distributions in the other densely populated channels are known. The influence of the heavy ion potentials and the level density parameters is small even if not negligible. The application to simpler reactions such as (α,n), (α,2n), (α,p) is less critical and should allow the assigning of many spins. (GE)

12961 (COO-2271-39) ABNORMAL NUCLEAR STATES. Lee, T. D. (Columbia Univ., New York (USA)). 1974. 20p. (CONF-740713-34). Dep. NTIS $4.00.

From 17th international conference on high-energy physics; London, UK (1 Jul 1974).

It has been suggested that, if there exists a strongly interacting 0^+ meson, then there exists the possibility of "abnormal nuclear states," hitherto unobserved. The simple quasi-classical arguments that led to such a suggestion are reviewed, and then its theoretical basis is examined in the context of a relativistic quantum field theory. A simple renormalizable theory consisting of a spin-0 Hermitian field and a spin-$^1/_2$ nucleon field is considered. If the nucleon density is sufficiently high, the system may exist in an "abnormal nuclear state," in which the effective nucleon mass becomes zero, or nearly zero. The σ model is discussed in this connection. (4 figures) (RWR)

12962 (COO-2271-43) ABNORMAL NUCLEAR STATES AND VACUUM EXCITATIONS. Lee, T. D. (Columbia Univ., New York (USA)). 1974. 19p. (CONF-740731-1). Dep. NTIS $4.00.

From international school of subnuclear physics; Erice, Italy (14 Jul 1974).

The purpose of this admittedly speculative work was to investigate the structure of the vacuum; it led to the suggestion of the possible existence of some hitherto unobserved physical objects. The existence of a strongly interacting neutral spin-0 even-parity meson (or resonance) is assumed. It can be represented by $\phi(x)$ in a rather large volume Ω. If Ω is filled with nuclear matter, one may obtain abnormal nuclear states; if it does not contain any nuclear matter, pure vacuum excitation states. Abnormal states are those in which the "effective" nucleon mass inside the nucleus is approximately zero. They are discussed in connection with the σ model. Under certain conditions the abnormal state is stable; it is the lowest energy state with a substantially larger binding energy per nucleon than that in the normal state. In a collision between an abnormal nuclear state and a normal nucleus, some of the resulting fragments will be normal and some, abnormal. Occasionally, however, a new object called the "vacuum excitation" state will result. One can view it as a gigantic meson "blob", much larger than the typical particle. Its width is discussed for both degenerate and nondegenerate cases. (8 figures, 1 table) (RWR)

12963 (COO-3494-23) MECHANISMS OF HEAVY ION REACTIONS FROM A MACROSCOPIC VIEWPOINT. Blann, M. (Rochester Univ., N. Y. (USA)). Sep 1973. 79p. (CONF-730997-). Dep. NTIS $7.00.

From 6th summer school on nuclear physics; Mikolajki, Poland (3 Sep 1973).

Theoretical considerations concerning the height of the fusion barriers for heavy-ion reactions and limits to the fusion cross sections are discussed. Areas of current investigation related to the dynamics of heavy-ion reactions are qualitatively described. The application of the rotating liquid drop model to survival of fused systems is discussed. Experimental results which are relevant to the various models are described and interpreted in terms of the limitations predicted by the various models. Predictions as to limiting cross sections for the production of new proton-rich nuclei by an evaporation mechanism are also described. (30 figures) (auth)

12964 (COO-3496-45) SELECTED ASPECTS OF VERY HEAVY ION REACTIONS. Huizenga, J. R. (Rochester Univ., N. Y. (USA). Nuclear Structure Research Lab.). Aug 1974. 133p. (CONF-740979-1; UR-NSRL-90). Dep. NTIS $9.75.

From lectures on selected aspects of very heavy ion reactions; Warsaw, Poland (2 Sep 1974).

These lectures on reactions of very heavy ions are limited to projectiles at least as heavy as ^{40}Ar and relatively heavy targets. The various types of reaction components making up the total reaction cross section are discussed at some length. Various nuclear potentials used in frictional-model calculations are reviewed. The nuclear potential calculated by the folding procedure is shown to give values of the nuclear force which are much larger than the limiting value from the liquid drop model. A Woods–Saxon nuclear potential for heavy-ion reactions with parameters estimated by equating its maximum nuclear force with the liquid-drop-model force is discussed in some detail. Experimental results for ^{40}Ar and ^{84}Kr projectiles are exhibited, and heavy-ion reactions for composite systems of about the same charge and mass are compared. In the final part, limiting angular momentum, entrance channel considerations, the role of the nuclear potential, reaction times, and angular momentum transfer are discussed. (23 figures, 8 tables) (RWR)

12965 (INDC(CCP)-35/U) NUCLEAR PHYSICS RESEARCH IN THE USSR. Collected Abstracts, Issue 15. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). Oct 1974. Translated from Russian. 55p. Dep. NTIS (US Sales Only) $5.75.

Abstracts or summaries of 29 papers written in the course of nuclear physics research in the USSR are presented. These papers describe various computer programs. Most of the programs are concerned with the calculation of cross sections, particularly for neutrons. (RWR)

12966 (INDC(CCP)-42/U, pp 18-70) POLARIZATION AND ANGULAR DISTRIBUTION OF RESONANT NEUTRONS. Saprykin, E. M.; Lukyanov, A. A. Aug 1974. Translated from Russian. In nuclear constants, No. 9.

The polarization of the spin of a neutron relative to its direction of motion occurs as a result of a strong dependence of the interaction potential on the spin state of the colliding particles. Neutron polarization is usually associated with the presence of a spin–orbit interaction. In principle, study of the interaction of polarized particles with oriented nuclei enables one to determine the corresponding nuclear reaction parameters which characterize the interaction potential for the different spin states of the colliding particles. The problem is first defined precisely. Then wave functions in the external region are discussed, both channel spin wave functions and the wave functions of relative motion. The amplitude of the reaction is considered, and this is followed by discussions of the following scattering cases: scattering of partially polarized nucleons by unpolarized nuclei, scattering of partially polarized nucleons by nuclei with zero spin, scattering of neutrons by ^{7}Li nuclei, the reaction ^{7}Li(p,n)^{7}Be, scattering of neutrons by ^{4}He nuclei, and elastic scattering of neutrons by ^{12}C nuclei. Vector summing coefficients and polarization at isolated resonances are taken up in appendixes. (15 figures, 1 table) (RWR)

12967 (INIS-mf-1396, pp A1-A11) ISOSPIN SPLITTING OF THE GIANT DIPOLE RESONANCE IN NUCLEI. P. du Fourie, T. (Atomic Energy Board, Pelindaba, S. Afr.). 1972. (In Afrikaans).

From 7th annual seminar on theoretical physics; Johannesburg (3 Jul 1972).

A general discussion is given on the isospin splitting of the giant dipole resonance for nuclei with $N \neq Z$. By using delta function and surface-delta function interactions, the energy splitting ΔE, the width of the $T_>$ states and the distribution of the dipole state are calculated for various closed-shell and closed-subshell nuclei. (INIS)

12968 (INIS-mf-1396, pp D1-D11) NEARLY SEPARABLE POTENTIALS. Erens, G.; Fiedeldey, H. (Univ. of South Africa, Pretoria). 1972.

From 7th annual seminar on theoretical physics; Johannesburg (3 Jul 1972).

A class of nearly separable potentials is defined by the requirement that the Noyes–Kowalski half-off-shell function is nearly independent of the strength of the potential. For such potentials simple expressions can be derived for the scattering length, the effective range, and the phase shifts. These relations are investigated numerically for the Tabakin rank-two separable potential, the local Malfliet–Tjon potential, the square well, and the purely attractive Yukawa potential. (INIS)

12969 (INIS-mf-1396, pp E1-E25) YRAST LEVELS AND COMPOUND NUCLEUS DE-EXCITATION. Hartmann, K. M. (Univ., Cape Town). 1972.

From 7th annual seminar on theoretical physics; Johannesburg (3 Jul 1972).

A review of the methods used to describe the de-excitation of compound-nucleus states formed in heavy-ion reactions is given. It is shown how the contribution from different mechanisms depends on the proximity of the states in question to the Yrast levels. Calculations of Yrast levels are also reviewed. (INIS)

12970 (JINR-P1-8153) PERSPECTIVES OF INVESTIGATION ON HYPERON PHYSICS AND MULTIBARYONIC RESONANCES IN COLLISIONS OF RELATIVISTIC NUCLEI. Shakhbazyan, B. A.; Temnikova, P. P.; Timonina, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The possibility of the acceleration of heavy ions up to relativistic energies opens a new area for important investigations in high energy physics. Among the problems arisen forming a long list three basic problems of hyperon physics were chosen which seem to be the most important ones in understanding the fundamental problems of the elementary particle physics, nuclear matter, and astrophysics: The search for and investigation of multibaryonic resonant states and especially the multihyperonic resonances. The search for and investigation of superstrange nuclei, i.e., the hypernuclei of $S \ll -1$. The investigation of superhigh density states of the nuclear matter. All these problems are needed for the knowledge of the hyperon production effective cross sections in collisions of relativistic heavy ions with various nuclei at various energies per nucleon. The corresponding estimates were based on a model in which the colliding nuclei were assumed to be made up of a fermion gas. As a first step the probabilities of a hyperon creation in passage of a nucleon through the nuclei of various atomic numbers A were calculated. Assuming the incident nucleus B to consist of B independent nucleons each moving with the same momentum equal to the accelerating momentum per nucleon and using the above mentioned probabilities it was possible to calculate the probabilities of the creation of N hyperons out of B nucleons. Then the effective cross sections of the formation of various superstrange nuclei and various multiplicities of free hyperons were estimated for 5.5 and 25 GeV/n. The results were used to estimate the yields of corresponding events in JINR propane and Xe bubble chambers. Tables for effective cross sections and yields are given. (auth)

12971 (JINR-P4-8077) CONSTRUCTION OF COLLECTIVE HAMILTONIAN IN MICROSCOPIC NUCLEAR MODEL. II. Dzholos, R. V.; Densu, F.; Yanssen, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 23p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Based on the collective Hamiltonian, which is constructed by the method of the boson representations of fermion operators, expressions are obtained for the potential energy, mass coefficients, and moments of inertia. In the framework of a simple model the comparison of the potential energies, which are found by the self-consistent field method and the method suggested, is made. (auth)

12972 (JINR-P4-8121) INVERSE PROBLEM FOR PROCESSES WITH EXCITATION OF NUCLEAR COLLECTIVE STATES AND RECONSTRUCTION OF VELOCITY DEPENDENT POTENTIALS. Zakhar'ev, B. N.; Suz'ko, A. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

It is shown that it is possible to reconstruct from scattering data the "optical" potential of the nucleus $V(\vec{r})$, its radial and angular dependences, in spite of the target rotation and vibration which make more complicated the picture of interaction of scattering particles with nuclei. The inverse scattering problem for velocity dependent potentials (depending on $\hat{p}^2$) is also formulated. (auth)

12973 (ORO-4317-42) ANALOG SPIN WAVE FUNCTIONS AND SPREADING WIDTHS OF ISOBARIC ANALOG RESONANCES. Technical Report No. 75-024. MacDonald, W. M.; Auerbach, N. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Sep 1974. 11p. Dep. NTIS $4.00.

The coupling of the isobaric analog state (IAS) to the giant isovector monopole state has been shown by Mekjian and Auerbach to affect the calculation of the spreading width dramatically. It is shown here that the inclusion of this coupling is equivalent to a new definition of the IAS as an eigenstate of analog spin in which each proton radial wave function is distorted relative to the corresponding neutron radial wave functions by the central Coulomb field. (auth)

12974 BASIS FUNCTIONS OF THE UNITARY-SCHEME IN THE COLLECTIVE VARIABLES. Petrauskas, A. K.; Sabalyauskas, L. Yu.; Perkauskas, D. Ch. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 5-9(1974). (In Russian).

The construction of the basis function of the unitary scheme in the system of the collective variables is investigated. Their explicit expression for the states of the monopole and quadrupole excitations are presented. The relations between the unitary-scheme functions and the unified model functions are discussed. (auth)

12975 INNER BREMSSTRAHLUNG IN ELECTRON PAIR CREATED IN GENERAL NUCLEAR TRANSITIONS. Burkhardt, H.; Zia, R. K. P. (Univ. of Birmingham, Eng.). J. Phys., A (London); 7: No. 14, 1726-1730 (21 Sep 1974).

The description of zero–zero transitions (Burkhardt et al., J. Phys. A. Math. Nucl. Gen.; 7: 1167 (1974)) is extended to general spin transitions. The decay distributions, both for pair creation and its inner bremsstrahlung, are given for experiments where no polarizations are observed, in terms of two structure functions which may be measured in either process; in most simple cases where a single multipole dominates these are theoretically related. (auth)

12976 INTERMEDIATE STRUCTURE IN NUCLEON–NUCLEUS SCATTERING. Weigel, M. K. (Univ., Munich). J. Phys., A (London); 7: No. 14, 1731-1747 (21 Sep 1974).

The problem of inelastic nucleon–nucleus scattering is formulated in the framework of Green functions. In this microscopic description, the noninstantaneous (energy-dependent) part of the effective particle–hole force (irreducible vertex) determines the non-direct contributions to the scattering matrix. In order to obtain the intermediate structure this vertex is studied in more detail and several approximations are given. Couplings of virtual phonons of different kinds play an important role in this procedure. If one goes beyond perturbation theory, three different effective forces occur in the coupling process. The connection to microscopic nuclear structure calculations is discussed. The general form of the T matrix emerging from the structure of the effective particle–hole force is given. Additionally, more explicit expressions are derived by assuming certain structures of the final nuclear state. (auth)

12977 DYNAMIC STRUCTURE OF NUCLEAR STATES. Rowe, D. J.; Trainor, L. E. H.; Wong, S. S. M.; Donnelly, T. W. (eds.). Toronto; University of Toronto Press (1972). 585p. $20.00.

This book is the collected works of the presentations of the 1971 Mont Tremblant international summer school on nuclear structure. Seventeen separate topics are covered in both theoretical and experimental aspects of nuclear structure or topics related to nuclear structure. (CA)

12978 REACTION DYNAMICS. Levin, F. S.; Feshbach, H. Documents on Modern Physics. New York; Gordon and Breach, Science Publishers, Inc. (1973). 222p. $19.25.

There were two lectures included. Separate abstracts were prepared for all lectures. (JFP)

For abstracts of individual lectures see: 12979 and 12980.

12979 RECENT DEVELOPMENTS IN THE THEORY OF DIRECT REACTIONS. Levin, F. S. (Brown Univ., Providence). pp 1-167 of Reaction Dynamics. Levin, F. S. New York; Gordon and Breach, Science Publishers, Inc. (1973).

Lectures are given examining some of the failures, successes, derivations, and extensions of direct-reaction theory, particularly as indicated in the recent literature. The DWBA model for stripping, validity of the DWBA model, core excitation, knock-out processes, spin-dependent effects, strong-coupling results, unbound final states, and new approaches are covered. (JCP)

12980 TOPICS IN THE THEORY OF NUCLEAR REACTIONS. Feshbach, H. (Massachusetts Inst. of Tech., Cambridge). pp 169-216 of Reaction Dynamics. Levin, F. S. New York; Gordon and Breach, Science Publishers, Inc. (1973).

Lectures are given reviewing various elements in the development of a general theory of reactions and showing how these elements might be used to calculate cross sections from the fundamental nuclear interactions. A unified formulation of reaction theory is discussed which appears to have a very simple conceptual basis and derivation which leads quite directly to resonance theory, the optical model, direct interactions, and intermediate structure. The topics include a brief review of scattering theory, prompt and time-delayed processes in nuclear reactions, the projection-operator technique, a general expression for the transition amplitude, resonance theory, derivation of the optical model potential, energy averaging, the reactance matrix, the Pauli principle, intermediate structure in nuclear reactions, and isobaric analog resonances. (JFP)

12981 DIRECT REACTION MULTIPLE SCATTERING PION–NUCLEUS OPTICAL MODEL POTENTIAL. Lucas, C. W. Jr. Williamsburg, VA; Coll. of William and Mary (1974). 377p. University Microfilms Order No. 74-22,287.

Thesis (Ph. D.).

The purpose of this work is to derive an on-shell pion–nucleus optical-model potential from multiple scattering theory in terms of πN and πNN interaction amplitudes and to demonstrate that this Kisslinger-type potential is adequate to describe pion–nucleus interaction data satisfactorily. The derivation of the potential leads naturally to a form of the Lorentz–Lorenz effect with contributions due to virtual charge exchange and virtual spin flip. Also, the derivation properly accounts for some aspects of nucleon motion and includes relativistic kinematical factors like $1 + E_\pi/m_N$. Using the Fermi-averaged πN amplitudes of Donnachie and Shaw and the calculated πNN amplitude of Dover, one finds that the potential qualitatively and quantitatively describes rather satisfactorily the pion–nucleus interaction data for ^{4}He, ^{12}C, ^{16}O, and ^{40}Ca for laboratory pion kinetic energy from 0 to 280 MeV. (Diss. Abstr. Int., B)

12982 SEMICLASSICAL DESCRIPTION OF FAST-NEUTRON CROSS SECTIONS. Angeli, I.; Csikai, J.; Nagy, P. (Kossuth Univ., Debrecen, Hungary). Nucl. Sci. Eng.; 55: No. 4, 418-426 (Dec 1974).

The predictions of a semiclassical optical model are compared with experimental nonelastic, integrated elastic-, and differential elastic-scattering cross sections at 14 MeV in a wide mass-number range. Considering the simplicity of the model, the agreement is fairly satisfactory using a single pre-fixed parameter set; the only modification that had to be performed was the introduction of a mass-number-dependent nuclear radius parameter, $r_0(A)$, instead of the constant initial value. The simple analytical expressions are especially useful for quick estimation of unmeasured cross sections. (6 figures) (auth)

12983 INVESTIGATION OF METHODS FOR NEUTRON CROSS SECTION ERROR IDENTIFICATION UTILIZING INTEGRAL DATA. Chow, E. T. Atlanta; Georgia Inst. of Tech. (1974). 161p. University Microfilms Order No. 74-21,561.

Thesis (Ph. D.).

There exist various fitting procedures on how to utilize effectively discrepancies between theoretical and experimental integral parameters for fast reactors to diagnose the uncertainties in nuclear quantities. This work considers different fitting schemes, by varying the multigroup structure and the type of integral data, and attempts to determine under what conditions meaningful information on the improvement of cross section data can be obtained. The study involves investigations of up to four energy groups and utilizes both the multiplication constants and the reaction rate ratios. The sensitivity coefficients of the integral data to cross section changes were calculated by utilizing normal and generalized perturbation theory. A systematic method was used to introduce cross section errors, and a new figure of merit was employed for interpretation of the results from error identification. This work investigates questions about cross section error identification with fitting schemes, such as the influence of the energy dependence, the effects of considering or ignoring cross section correlation ratios, the empirical choice of the constraint size in a procedure which constrains the identified cross section errors, the proper choice of the weighting factor between the integral and the cross section data in a procedure which uses both in the fit, and the advantage of utilizing combinations of different types of integral data in the fitting. (RWR)

12984 VARIATIONAL CALCULATIONS IN THE NUCLEAR THREE-BODY PROBLEM IN THE HARMONIC OSCILLATOR BASIS. Majling, L. (Inst. of Nuclear Physics, Rez, Czech.); Rizek, J.; Pluhar, Z. Czech. J. Phys.; 24: No. 11, 1306-1307 (1974).

Some results of trinucleon variational calculations are presented. The harmonic oscillator functions characterized by quantum numbers corresponding to group reduction were used as a basis. Particular interest was in the dependence of results on two nonlinear parameters $\hbar\omega$ and N and the possibility of further reduction of the basis employed using the additional quantum numbers (λ, μ) and Ω. Results for two potentials with gaussian radial dependence, the simple Baker and the Eikemeier–Hackenbroich potential with soft core repulsion, are given. (JFP)

12985 STRUCTURE OF LIGHT P-SHELL NUCLEI. Irvine, J. M.; Mani, G. S.; Vallieres, M. (Univ. of Manchester, Eng.). Czech. J. Phys.; 24: No. 11, 1269-1276 (1974).

It is demonstrated for the first time that a number of observed low lying nuclear states in light p-shell nuclei are in fact eigenstates of a two-body hamiltonian which describes the two nucleon system. It is observed that in some heavier p-shell nuclei there appear states which may not be eigenstates of this Hamiltonian. (auth)

12986 QUASIFREE PROCESSES AND FEW-BODY SYSTEMS. Slaus, I. (Inst. Rudjer Boskovic, Zagreb). Czech. J. Phys.; 24: No. 11, 1255-1268(1974).

The progress achieved during the last two years in the understanding of quasifree processes in three- and four-nucleon systems and evidence for quasifree reaction mechanisms in more complex systems are presented. Some applications of quasifree processes are discussed. (auth)

12987 REPULSIVE CORE EFFECTS IN (d,p) STRIPPING REACTIONS USING A TABAKIN POTENTIAL. Osman, A.; Goumry, N. (Cairo Univ. (Egypt). Dept. of Physics). Atomkernenergie; 24: No. 1, 55-61(1974).

12 figs.; 2 tabs.; 14 refs.

Using a Tabakin potential for the neutron-proton interaction the form factor for (d,p) stripping reactions is calculated. The effect of introducing the repulsive core is considered. Taking a Yamaguchi or Breit et al. type for the neutron-proton interaction, the effect is found to be small. In case of using the Breit et al. form for the repulsive part, it is found to be important in extracting the correct spectroscopic factors. (auth)

12988 SQUARE GRAPHS IN DIRECT NUCLEAR REACTIONS AT MODERATE ENERGIES. Gurbanovich, I.S.; Magzumov, E.Z.; Neudatchin, V.G.; Romanovsky, E.A.; Tchuvil'sky, Y.M. (Institute of Nuclear Physics, Moscow State University, Moscow, USSR). Ann. Phys. (N.Y.) 87: No. 2, 263-288 (Oct 1974).

The present work contains the analysis of various reactions proceeding at relatively small projectile energies (~ 10 MeV) for which a mechanism described by the square diagram may be regarded as a dominant one. It is shown that such a mechanism may be realized both in reactions in which one or several nucleons are transferred and in reactions of nucleon or deutron inelastic scattering. Also, such an interesting property of the above diagrams is discussed as the extremely well pronounced forwardness of the angular distributions for the processes of inelastic scattering. Various variants of the theory are examined (DWBA, oscillator approximation, etc.). Formal properties of the square diagrams are also studied such as the dependence of differential cross section shape on the value of total orbital momentum transferred and the approximation on an energy surface for its calculation. (auth)

12989 ANALYTIC PROPERTIES OF THE EFFECTIVE INTERACTION IN NUCLEI INVESTIGATED ON SIMPLE MODELS. Schaefer, P.A. (Department of Nuclear Physics, Weizmann Institute of Sciences, Rehovot, Israel). Ann. Phys. (N.Y.) 87: No. 2, 375-416 (Oct 1974).

The analytic properties of the effective interaction W as a function of the residual interaction strength are investigated in the frame-work of a simple 2×2 model. Brandow's folded diagram expansion taken order by order in the interaction converges to W only as long as the residual interaction does not force an outside level to cross into the model space spectrum. By reordering the series one can construct an approximation to an analytic continuation of W beyond the crossing region. To improve upon the latter approximation one has to resort to iteration methods. The results are generalized to the N×N case and numerical illustration on a 3×3 model is provided. (auth)

12990 RELATIONS BETWEEN COULOMB DISPLACEMENT ENERGIES AND NUCLEAR BINDING ENERGIES. Nir, D. (Hebrew Univ., Jerusalem). Can. J. Phys.; 52: No. 21, 2132-2134 (1 Nov 1974).

Shell effects in binding energies are compared to shell effects in Coulomb displacement energies. A phenomenological relation is suggested which predicts the Coulomb energies from the binding energies and reproduces these shell effects. (auth)

12991 SOLUTION OF THE THREE-BODY SCATTERING PROBLEM IN CONFIGURATION SPACE. Gignoux, G.; Laverne, A. (Laboratoire de Physique Nucléaire, Université de Montréal, Montréal, Canada); Merkuriev, S.P. Phys. Rev. Lett. 33: No. 22, 1350-1352 (25 Nov 1974).

The correct asymptotic behavior of the wave function deduced from the Faddeev equations for three-particle scattering is used to determine the asymptotic conditions. With these conditions, the equivalent set of partial differential equations in configuration space has a unique solution and is numerically solved for two examples. Comparison is made with results from two other basically different methods. (auth)

12992 MICROSCOPIC CALCULATIONS OF THE POTENTIAL ENERGY SURFACE FOR DEFORMED AND TRANSITIONAL NUCLEI. Sobiczewski, A. (Inst. for Nuclear Research, Warsaw). Nukleonika; 19: No. 7-8, 625-636(1974).

Microscopic methods for the calculation of the potential energy surface as a function of nuclear deformation are discussed. Attention is given principally to the methods of the calculation of the shell correction to the energy and to the illustration of the recent results obtained for the energy surface of even-even deformed and transitional nuclei. (10 figures) (auth)

12993 SELF-CONSISTENT DESCRIPTION OF DEFORMED NUCLEI USING THE SKYRME EFFECTIVE INTERACTION. Quentin, P. (Institut de Physique Nucleaire, Orsay, France). Nukleonika; 19: No. 7-8, 637-644(1974).

Some recent results obtained in self-consistent calculations (including an approximate treatment of pairing correlations) are briefly reviewed. An improved set of parameters for the Skyrme phenomenological interaction is used which allows a reproduction of experimental masses within an error ≤5 MeV. The description of various deformation properties is discussed in the s-d shell and rare earth region, for some mercury isotopes, and for the fission barrier of ^{240}Pu. Finally, a method to check the Strutinsky prescription, together with some preliminary results, is also presented. (5 figures, 2 tables) (auth)

12994 ON THE BROKEN Sp(3,3) SYMMETRY AND THE SPECTRA OF DEFORMED EVEN-EVEN NUCLEI. Raichev, P. P. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). Compt. Rend. Acad. Bulg. Sci.; 25: No. 11, 1503-1505(1972).

Finite rotational bands can be incorporated in the multiplets of the SU(3) group. The question is whether in the spectra of the nuclei one can distinguish sets of states which can be combined though formally, into one or several multiplets of the SU(3) group. The analysis of the experiment gives a positive answer to this question. On these grounds a hypothesis that the positive parity states of the deformed even-even nuclei form (λ, μ) multiplets of SU(3) with high values of λ and small values of μ (λ, μ, even) is formulated. It is pointed out that this arrangement can acquire a physical meaning only if it is capable of explaining the energy spectrum and transition probability in the nuclei. Only the possible causes of the origin of the SU(3) multiplets are discussed. The angular momentum operators and the tensor of the electrical quadrupole momentum of the system of N charged particles generate the noncompact Sp(3,3) group. It was mentioned earlier that Sp(3,3) is the most suitable dynamical group describing both vibrational and rotational movements in nuclei. Interaction between nucleons splits the multiplet of Sp(3,3) into multiplets of SU(3). Among the operators breaking Sp(3,3) symmetry up to SU(3) is the free Hamiltonian. In their turn, the multiplets of SU(3) split into states of a definite angular momentum. A model Hamiltonian is written down. (INIS)

12995 SOME ASPECTS OF THE EXCITON MODEL OF NUCLEAR REACTIONS. Betak, E.; Oblozinsky, P.; Ribansky, I. (Inst. of Physics, Bratislava). Nukleonika; 19: No. 7-8, 687-692 (1974).

Transition rates, the equilibration process, emission of complex particles and the influence of the shell structure on the decay are discussed in the framework of the exciton model of nuclear reactions. (4 figures) (auth)

12996 FOUR-BODY-MODEL—INTERACTIONS IN NUCLEI. Szpikowski, S.; Trajdos, M. (Univ., Lublin). Nukleonika; 19: No. 7-8, 727-732(1974).

The authors give a generalization of previous results concerning the four-particle correlations in atomic nuclei. This generalization refers to odd nuclei. Group-theory methods for diagonalization of the Hamiltonian with a four-body part were applied. A number of interesting conclusions were drawn from the considerations. (7 figures) (auth)

12997 PRE-EQUILIBRIUM PARTICLE EMISSION AFTER NUCLEAR MUON CAPTURE. Kozlowski, T.; Zglinski, A. (Inst. of Nuclear Research, Swierk, Poland). Nukleonika; 19: No. 7-8, 721-725(1974).

A simple model of nuclear muon capture based on the giant resonance supermultiplet is presented. A unified description of the total capture rate for light and heavy nuclei and the emitted particle spectra has been obtained. (3 figures, 1 table) (auth)

12998 R-MATRIX DESCRIPTION OF ALPHA DECAY. Holan, S. (Joint Inst. for Nuclear Research, Dubna, USSR); Rodan, R.; Sandulescu, A. Rev. Roum. Phys.; 19: No. 5, 511-523(1974).

The channel radius R_0 dependence of the decay constant $\lambda(R_0)$ in the R-matrix theory of alpha decay is studied for $^{210}P_0$ and $^{212}P_0$. It is shown, that because of the poles in the penetrability, any numerical values for $\lambda(R_0)$ can be obtained for R_0-values close to the surface of the nucleus. By using similar R-matrix hypotheses in the Born-Casimir theory of alpha decay a new expression for λ is obtained, which does not contain the penetrability explicitly. The new expression is also strongly dependent on R_0. The discrepancy between theory and experiment for λ-absolute values can be reduced by several orders of magnitude by choosing R_0 at the maximum of the decay constant λ. It was concluded that a constant value for $\lambda(R_0)$ over a large range of R_0 can be obtained, if the last node of the amplitude of the reduced width $\gamma(R_0)$ coincides approximately with the last pole of the penetrability. (auth)

12999 SOME PROBLEMS RELATED TO A COMPLETELY ANTISYMMETRIZED R-MATRIX THEORY. Baye, D.; Heenen, P. H. (Univ., Brussels). Bull. Cl. Sci., Acad. Roy. Belg.; 60: No. 4, 444-457(1974). (In French).

Various problems raised by the elaboration of an antisymmetrized R matrix theory are considered: a well defined interior region; the construction of a Bloch L operator coherently approximated with the R matrix theory; the effective building of matrix elements in the interior region. (auth)

13000 ISOSPIN IN NUCLEAR PHYSICS. Renon, M. J. (University of the Witwatersrand, Johannesburg (South Africa). Nuclear Physics Research Unit). S. Afr. J. Sci.; 319-323(May 1971). 6 refs.

Aspects of the isospin quantum number that have recently come into prominence are discussed. Particular attention is paid to the research work currently being done and in particular work at Univ. of Witwatersrand. Results of the investigations on the isospin parity of ^{14}N are presented. (INIS)

13001 PREDICTIONS FOR NUCLEUS–NUCLEUS SCATTERING AT HIGH ENERGIES. Fishbane, P.M.; Trefil, J.S. (Department of Physics, University of Virginia, Charlottesville, Virginia 22901). Phys. Rev. D 10: No. 9, 3128-3131 (1 Nov 1974).

We predict values for cross sections and elastic scattering slopes of nucleus–nucleus scattering at Berkeley Bevelac energies. In particular we discuss factorization of cross sections, predicting factorization will approximately occur over a wide range of nuclei. (auth)

13002 EFFECT OF CURVATURE ON NUCLEAR SURFACE ENERGY. Bennett, C.D. (Computer–based Education Research Laboratory and Physics Department, University of Illinois, Urbana, Illinois 61801); Ravenhall, D.G. Phys. Rev. C 10: No. 5, 2058-2066 (Nov 1974).

For nuclear matter described by the Skyrme Hamiltonian, treated in the Thomas–Fermi one–fluid approximation, an examination is made of the dependence on curvature of the nuclear surface energy and the surface–tension pressure. These quantities are related in a manner which depends on the definition of the surface position. This question is explored both analytically and numerically for the first four terms in the expansion in powers of the curvature. The second–order term in the expansion which depends on the difference of the principal curvatures is also evaluated. The contribution of these effects in the nuclear mass formula is discussed briefly. (auth)

13003 GENERAL BOSON EXPANSION THEORY AND LIE ALGEBRAS B_n AND D_n. Okubo, S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). Phys. Rev. C 10: No. 5, 2048-2057 (Nov 1974).

A general boson expansion theory for even and odd fermion states has been developed in both Dyson and unitary representations. We can construct them in several different forms, one of which essentially reproduces the formula of Marshalek. The underlying algebra may or may not obey the associative law. A connection of the theory with the Lie algebras B_n and D_n has been investigated. As a by–product, construction of fermion annihilation and creation operators solely in terms of boson operators has been found. (auth)

13004 NUCLEAR MUON–CAPTURE SUM RULES AND MEAN NUCLEAR EXCITATION ENERGIES. Goulard, B. (Laboratoire de Physique Nucléaire, Université de Montréal, Montréal, Canada); Primakoff, H. Phys. Rev. C 10: No. 5, 2034-2044 (Nov 1974).

A discussion is given of non–energy–weighted and of energy–weighted sum rules in nuclear muon capture. It is argued that the mean nuclear excitation energy in muon capture does not vary appreciably as A and Z vary. A combined non–energy–weighted and energy–weighted sum rule which constitutes a three–parameter fit to the experimental data on total muon–capture rates is presented. (auth)

13005 NONASSOCIATIVE ALGEBRA IN NUCLEAR BOSON–EXPANSION THEORY. Okubo, S. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). Phys. Rev. C 10: No. 5, 2045-2047 (Nov 1974).

We will show that Marshalek's theory of the boson–expansion method for an odd–fermion system leads to a nonassociative algebra. Nevertheless, explicit forms of the ideal Marumori space as well as exact boson–expansion formulas have been found to be essentially unchanged from those obtained by Marshalek. (auth)

13006 BRUECKNER–HARTREE–FOCK CALCULATIONS AND THEIR DENSITY DEPENDENCE. Tripathi, R.K.; Faessler, A.; Müther, H. (Institut für Kernphysik, der Kernforschungsanlage Jülich, D–517 Jülich, West Germany). Phys. Rev. C 10: No. 5, 2080-2088 (Nov 1974).

Brueckner–Hartree–Fock (BHF) calculations are presented taking into account the Pauli operator in the self–consistent basis rather than in the oscillator basis. The definition of the single-particle energies includes an on–shell rearrangement diagram (starting energy rearrangement) stemming from the only partial occupation of the occupied states due to the short-range correlations. Further, it includes an off–shell diagram (Pauli rearrangement) term which originates from the density dependence of the Pauli operator. The three additional terms, the correction for the self–consistent Pauli operator, the starting energy, and the Pauli rearrangement terms, contribute significantly to the nucleus. It is shown that the definition of the single-particle energies is analogous to that in density-dependent Hartree–Fock calculations. One obtains all the effects of a density-dependent force within the BHF formalism without making a detour to nuclear matter, and thus avoids many of the approximations used in the calculations with density-dependent forces. The method is applied here for ^{16}O using the Reid soft-core and the Yale potential. (auth)

13007 CONTRIBUTIONS OF NUCLEON MOMENTA TO THE PION OPTICAL POTENTIAL. Cannata, F.; Lucas, C.W. Jr.; Werntz, C. (The Catholic University of America, Washington, D. C. 20017). Phys. Rev. C 10: No. 5, 2093-2095 (Nov 1974).

The pion–nucleus scattering amplitude in the impulse approximation is expressed in terms of the invariant matrix for pion–nucleon scattering. It is pointed out that the linear nucleon momentum terms evaluated in the nuclear ground state constitute a longitudinal current that is nonzero. It is shown that these terms reduce by a factor of 1/2 the $\nabla^2\rho(\vec{r})$ addition to the optical potential obtained by Kisslinger and Tabakin. (auth)

13008 IMPROVED PROJECTED HARTREE–FOCK DESCRIPTION OF THE LOW–LYING QUASIROTATIONAL STATES IN NUCLEI. Avignone, F.T. III; Sharma, S.K. (International Centre for Theoretical Physics, Trieste, Italy). Phys. Rev. C 10: No. 5, 2106-2108 (Nov 1974).

It is shown that the best single determinantal approximation to the low–lying collective states in nuclei can be significantly different from the one obtained by the usual Hartree–Fock procedure. (auth)

13009 DERIVATION OF A COUPLING POTENTIAL FOR COULOMB–NUCLEAR INTERFERENCE EFFECTS. Oberacker, V.; Holm, H.; Scheid, W. (Institut für Theoretische Physik der Universität Frankfurt, Frankfurt am Main, Germany). Phys. Rev. C 10: No. 5, 1917-1921 (Nov 1974).

A collective coupling potential for surface vibrations is calculated from an extended liquid drop model. It describes Coulomb and nuclear excitations. Applying the potential to the reaction $^{58}Ni(^{16}O, ^{16}O')^{58}Ni^*$, we obtain a good agreement with recent experimental data. (auth)

13010 CHANNEL COUPLING ARRAYS AND THE REDUCTION METHOD IN MANY–BODY SCATTERING. Hahn, Y. (Physics Department, University of Connecticut, Storrs, Connecticut 06268); Kouri, D.J.; Levin, F.S. Phys. Rev. C 10: No. 5, 1615-1619 (Nov 1974).

A differential equation formulation of the multichannel coupled equations of Kouri and Levin describing rearrangement scattering is given. The different channels are linked together in these equations through the presence of the channel coupling array W. It is shown that the earlier results of Hahn, derived using the reduction method, follow directly from the multichannel coupled equations by making specific choices of the array W. These particular W's guarantee that the iterated kernels of the coupled equations are connected in those channels which are explicitly considered, so that standard numerical techniques can be applied to their solution. (auth)

13011 LACK OF SPURIOUS SOLUTIONS IN THE COUPLED CHANNEL T OPERATOR FORMALISM. Hahn, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268); Kouri, D.J.; Levin, F.S. Phys. Rev. C 10: No. 5, 1620-1622 (Nov 1974).

The coupled equations for n–body rearrangement collisions derived previously using the reduction method and the channel coupling array method are explicitly shown to be free of Federbush disease. (auth)

13012 REGIONS OF THE TWO–NUCLEON FORCE. Gersten, A. (Department of Physics, Ben–Gurion University of the Negev, Beer–Sheva, Israel). Phys. Rev. C 10: No. 5, 1640-1644 (Nov 1974).

Using an approximate Bethe–Salpeter equation approximate values were obtained for the partial wave contributions of the two and three pion exchange ladder diagrams. With these results the region hypothesis of the two–nucleon force was tested for this model. No definite region structure was observed for the S and part of the P and D waves ($^1P_0$, $^3P_1$, $^3P_2$, $^3D_1$, $^3D_3$). A definite region structure was observed for other waves, but it was impossible to locate common (to all partial waves) radii for the outer and intermediate regions of this model of the two–nucleon interaction. (auth)

13013 RECOIL CORRECTIONS IN DISTORTED–WAVE BORN APPROXIMATION CALCULATIONS OF HEAVY–ION TRANSFER REACTIONS. Blair, J.S.; DeVries, R.M.; Nair, K.G. (Department of Physics, University of Washington, Seattle, Washington 98195); Baltz, A.J.; Reisdorf, W. Phys. Rev. C 10: No. 5, 1856-1863 (Nov 1974).

Various distorted-wave Born approximation (DWBA) theories which take only approximate account of recoil are assessed by comparing numerically their predictions to exact DWBA calculations of cross sections for heavy-ion transfer. Of these, the most successful for single-nucleon transfer appears to be that of Baltz, which treats recoil exactly through second order in the mass of the transferred particle. Also rather accurate are the first-order theories of Baltz and Kahana and of Reisdorf. The theory of Buttle and Goldfarb which incorporates their approximate correction for recoil is useful near and below the Coulomb barrier, especially when there is good "Q matching." Theories which completely neglect recoil are distinctly less reliable. None of the approximate theories here considered appear adequate for an example of α particle transfer. (auth)

13014 ARE THE GAPLESS EXCITATIONS RESPONSIBLE FOR THE BACK BENDING OF THE MOMENT OF INERTIA. Grin, Yu. T. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Phys. Lett., B; 52: No. 2, 135-137(30 Sep 1974).

An expression for the rotational frequency at which the gapless excitation arises in the nucleus was found. The consequences of the gapless excitation resulting in the back bending of the moment of inertia were analyzed. (auth)

13015 SELFCONSISTENT CALCULATIONS OF HIGHLY EXCITED NUCLEI. Brack, M.; Quentin, P. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett., B; 52: No. 2, 159-162 (30 Sep 1974).

Self-consistent calculations of excitation energies and entropies of highly excited nuclei were performed using the temperature-dependent constrained Hartree-Fock (HF) method with the Skyrme interaction. The self-consistent variations of the level spectra as functions of the temperature (at a fixed deformation) are shown to be small and practically do not affect the results for the entropy versus excitation energy. The disappearance of the shell fluctuations in the potential energy surface of a rare earth nucleus around $T \sim 3$ MeV is demonstrated. (auth)

13016 CORRECTED EXPRESSIONS OF THE ELECTROMAGNETIC TRANSITIONS IN THE EPSILON-REPRESENTATION OF THE NILSSON MODEL. Desgrolard, P. (Lyon-1 Univ., 69—Villeurbanne (France). Inst. de Physique Nucleaire); Midy, P. (Paris-11 Univ., 91—Orsay (France). Lab. de Physique Nucleaire et Hautes Energies). Phys. Lett., B; 52: No. 2, 169-171(30 Sep 1974).

Expressions for the E1 and E2 transition operators are given as functions of the stretched coordinates of the particle. Basis-independent relations follow between the corrected and noncorrected matrix elements. The differences between the associated numerical values appear to be most significant in the E2, $\Delta\Omega = 0$ case. (auth)

13017 COMPARISON OF THE MOST OFTEN USED METHODS FOR THE DESCRIPTION OF STRIPPING TO UNBOUND STATE IN A MODEL CALCULATION. Cseh, J.; Gyarmati, B. (ATOMKI, Debrecen, Hungary). ATOMKI (At. Kut. Intez.) Kozlem.; 16: No. 4, 299-314(1974). (In Hungarian).

The contribution of a resonance to the stripping cross section is generally computed in the framework of the DWBA. As form factor either the scattering wave function or Gamow function is used, and various mathematical and numerical procedures are adapted in order to speed up the slow convergence of the radial integral or to regularize the divergent integral. In a model in which the integrals can exactly be given (plane waves + square well), the cross section was computed with a representative of each above-mentioned method as well as with a formula from a generalization of the DWBA cross section by Berggren. The results led to the conclusion that in the case of approximately Lorentz-shaped resonances the different methods provide nearly identical cross-section values, but in the case of resonances having significant background the cross-section values are scattered (in the example presented by about 25%). (6 figures) (auth)

13018 MESON CONDENSATION AND ANOMALOUS NUCLEI. Migdal, A. B. (L. D. Landau Institute for Theoretical Physics, Moscow V-334, USSR). Phys. Lett., B; 52: No. 2, 172-174(30 Sep 1974).

The possibility of the existence of 1) superdense, 2) neutron and 3) supercharged nuclei is discussed. The stability of such nuclei can be provided by the π-condensation. (auth)

13019 LINE SHAPE IN WEAK AND INTERMEDIATE COUPLING: THEORY AND PRACTICAL FITTING PROCEDURES. Lane, A. M.; Lynn, J. E. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment); Moses, J. D. (Duke Univ., Durham, N. C. (USA). Dept. of Physics). Nucl. Phys., A; 232: No. 1, 189-199(28 Oct 1974).

Most of the theory available for the analysis of a broadened line assumes strong coupling between an original special state and background states with which it mixes. Many observed lines (analogs, fission doorways) are cases of weak or intermediate coupling, and the analysis of these in practice requires extensions of existing theory. It is shown that it remains useful to center the analysis on a "strength function", which has the usual Breit-Wigner shape with spreading width given by the golden-rule formula. (auth)

13020 ON THE CONTRIBUTION FROM A TWO-STEP MECHANISM, INVOLVING THE SEQUENTIAL TRANSFER OF TWO NEUTRONS, TO THE CALCULATION OF (p,t) REACTION CROSS SECTIONS. de Takacsy, N. B. (McGill Univ., Montreal, Quebec (Canada). Dept. of Physics). Nucl. Phys., A; 231: No. 2, 243-256(14 Oct 1974).

It is shown that the two-step (p,d) (d,t) mechanism can provide a satisfactory description of some "forbidden" (p,t) reactions leading to unnatural parity final states. The effect of this mechanism on allowed ground-state to ground-state transitions is investigated, and it is found that the relative sign of the one-step and two-step amplitudes must be reversed in order to obtain agreement with experiment. (auth)

13021 QUANTUM MECHANICAL COUPLED CHANNELS CODE FOR COULOMB EXCITATION. Roesel, F.; Saladin, J. X. (Pittsburgh Univ., Pa. (USA)); Alder, K. (Basel Univ. (Switzerland)). Comput. Phys. Commun.; 8: No. 1, 35-48(Aug 1974).

AROSA calculates amplitudes and cross sections for Coulomb excitation of even even nuclei (g.s. spin and parity 0^+). Up to five excited states may be included in the calculation. All reduced E2 and E4 matrix elements between these states may be taken into account. The set of radial second-order differential equations resulting from the Schroedinger equation is solved by outward integration from the vicinity of the origin. The integration method is based on the Taylor expansion whose coefficients are obtained from recursion relations. At larger distances a WKB procedure is employed. Convergence of the scattering amplitudes with the number of partial waves is improved by using a procedure which is related to the Padé approximation. (auth)

13022 THE LONG WAVE-LENGTH LIMIT OF ELECTRIC AND MAGNETIC MULTIPOLES RADIATION FROM THE ABSORPTION OF CHARGED PARTICLES BY COMPLEX NUCLEI. Bosco, B. (Istituto Nazionale di Fisica Nucleare, Florence (Italy)); Sacchi, M. T. (Cagliari Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 52: No. 2, 128-130(30 Sep 1974).

A current responsible for the absorption of charged particles from complex nuclei is defined in such a way that the continuity equation is valid also in the presence of a complex potential. Then the long wave-length limit is derived for the multipoles of the radiation of this current using only general arguments. In particular it is shown that if the potential is spherically symmetric all the magnetic multipoles are zero in this limit. (auth)

13023 FACTORIZATION IN RELATIVISTIC HEAVY-ION SCATTERING. Wang, W. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 52: No. 2, 143-145 (30 Sep 1974).

The total cross sections were calculated for relativistic nucleus-nucleus scattering in the Glauber theory, and it is concluded that there will be no factorization, due to the short-range nature of nucleon-nucleon interaction as compared to the sizes of the colliding nuclei. (auth)

13024 MULTIPLE SCATTERING OF HEAVY IONS, GLAUBER THEORY, AND OPTICAL MODEL. Wilson, J. W. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Phys. Lett., B; 52: No. 2, 149-152 (30 Sep 1974).

An exact multiple-scattering series for the scattering of two heavy ions is derived and compared to the Glauber approximation. An optical model potential operator is indicated which is an accurate approximation to the multiple-scattering formalism. (auth)

13025 A PARAMETRIZATION OF THE PHASE SPACE FACTOR FOR ALLOWED β-DECAY. Wilkinson, D. H.; Macefield, B. E. F. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., A; 232: No. 1, 58-92(28 Oct 1974).

The phase space factor for allowed β-decay is parametrized in the form: $f = f_{z=0} \exp\{\Sigma^3_{n=0} a_n (\ln E_0)^n\}$ for $|Z| \leq 101$ and for β-particle kinetic energy end points in the range 10 keV to 20 MeV ($f_{z=0}$ is the usual point nucleus phase space factor for $Z = 0$). The parametrization uses electron wave functions generated in a uniform spherical charge distribution of radius adjusted to fit electron scattering and muonic x-ray data and screened by the atomic electrons; allowance is made for the curvature of the lepton wave functions through the nuclear volume, for their convolution with

(rectangular) nucleon wave functions coterminous with the nuclear charge distributions, for all allowed combinations of $l = 0$ and $l = 1$ leptons of $j = \frac{1}{2}$, for the energy-dependent "outer" radiative correction of order α and for the finite mass of the nucleus. Within the context of its definition the parametrization is accurate to better than 0.1% everywhere. (auth)

13026 ELECTRON CAPTURE TO POSITRON DECAY RATIOS AND SECOND-CLASS CURRENTS. Behrens, H. (Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Experimentelle Kernphysik); Buehring, W. (Heidelberg Univ. (F. R. Germany). 2. (Physikalisches Inst.). Nucl. Phys., A; 232: No. 1, 230-234 (28 Oct 1974).

It is shown that electron capture to β^+ decay ratios are insensitive to the induced tensor interaction. The observables are given in terms of form factor coefficients, which are expressed in terms of coupling constants and reduced nuclear matrix elements. (auth)

13027 WAVE-PACKET DESCRIPTION OF NUCLEAR LIFETIME MEASUREMENTS BY CRYSTAL BLOCKING EXPERIMENTS. Yazaki, K.; Yoshida, S. (Rutgers—The State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Nucl. Phys., A; 232: No. 1, 249-268(28 Oct 1974).

The wave-packet theory of nuclear reactions was used to describe lifetime measurements by the crystal blocking effect. It was shown that the measurement is possible even for an incident wave packet of very long time duration; the fluctuation of the target position and the accuracy of measuring the position of the decay of the compound nucleus determine the fundamental accuracy of the lifetime measurement. The distribution of the decay points is discussed, based on the statistical properties of the resonance parameters. (auth)

13028 A SOLUBLE MODEL OF A VARIATIONAL CALCULATION WITH CORRELATIONS. Zamick, L. (Rutgers—The State Univ., New Brunswick, N. J. (USA). Dept. of Physics). Nucl. Phys., A; 232: No. 1, 13-21(28 Oct 1974).

The monopole—monopole interaction $\lambda r^2(1) r^2(2)$ is used both to get a Hartree potential and to obtain 1p-1h and 2p-2h correlations. The resulting variational problem is not difficult to solve. It is shown that although the optimum value of the oscillator parameter $\hbar\omega$ changes in such a way as to increase the mean square radius, the 1p-1h correlations resist this change to a large extent. The energy of the breathing mode is obtained both microscopically and macroscopically. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 11325, 11590, 11988, 12458, 12505, and 12870.

13029 (AD-783040) ORGANIZATIONAL DESCRIPTION OF HIGH ENERGY TRANSPORT CODE (HETC). Langworthy, J. B. (Naval Research Lab., Washington, D. C. (USA)). Jun 1974. 24p. (NRL-MR-2729). NTIS $3.00.

Flow charts and descriptions are presented of the two routines MAIN and CASCAD, and a functional description is provided for about half the remaining routines of high-energy transport code for nucleons and mesons. A description of the intranuclear cascade portion is not included. Most of the remaining reaction models are discussed, and the Monte Carlo transport technique is completely described. The detailed information presented here should be very useful in any evaluation of the utility of a prospective modification. (auth)

13030 (AD-783311) BETA-II, A TIME-DEPENDENT, GENERALIZED-GEOMETRY MONTE CARLO PROGRAM FOR BREMSSTRAHLUNG AND ELECTRON TRANSPORT ANALYSIS. Volume I. Summary Report. Report for 15 October 1970–9 October 1971. Jordan, T. M. (A. R. T. Research Corp., Los Angeles, Calif. (USA)). 29 Oct 1971. Contract F29601-72-C-0013. 38p. (ART-60-VOL-1). NTIS $5.00.

The physical assumptions used in BETA 2, a Monte Carlo computer program for Bremsstrahlung and electron transport analysis in complex geometries are summarized. The program is written in Fortran 4 for the CDC 6600, IBM 360, and UNIVAC 1108 computers. The BETA 2 program is designed primarily for electron energy deposition calculations but is also applicable to photons. The condensed history Monte Carlo technique is employed for electrons and the effects of fixed electric and magnetic fields or self-generated electric fields are also included. Results are presented for sample calculations of electron angular distributions, energy deposition profiles, bremsstrahlung production, and multidimensional energy deposition profiles with and without electric and magnetic fields. Where possible, comparisons are made with experimental data. The users manual for the BETA 2 program is contained in a companion volume. (auth)

13031 (BNL-19224) INTERNATIONAL NEUTRON DOSIMETRY INTERCOMPARISON. Goodman, L. J.; Colvett, R. D.; Caswell, R. S. (Brookhaven National Lab., Upton, N. Y. (USA); Columbia Univ., New York (USA). Radiological Research Lab.). 1974. Contract AT(11-1)-3243. 45p. (CONF-740986-1). Dep. NTIS $5.25.

From conference on international neutron dosimetry intercomparison; Neuherberg/Munchen, F. R. Germany (30 Sep 1974).

An International Neutron Dosimetry Intercomparison, sponsored by the International Commission on Radiation Units and Measurements, has been completed at the Radiological Research Accelerator Facility at Brookhaven National Laboratory. Fourteen groups of scientists, from six countries, performed measurements to determine the separate neutron and photon (x- and gamma-ray) tissue kermas in free air for four energies of monoenergetic neutrons, 15.5, 5.5, 2.1, and 0.67 MeV, and for a source of fission neutrons, ^{252}Cf. For the two highest energies, measurements were also made to determine the separate absorbed doses in tissue of neutrons and of photons at three depths in a large water phantom. (auth)

13032 (IFA-DRMN-1-1974) BASIC RELATIONSHIPS IN DOSIMETRY. Rebigan, F. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 12p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

The basic relationships between different concepts of physical concepts of physical dosimetry are given. This is made in order to facilitate the practical use of dosimetric concepts described in the last ICRU reports. Among these some new orthogonality relations are found which enable us to describe more completely the radiation beam. (auth)

13033 (INS-J-148) TOTAL ABSORPTION CROSS SECTION OF 250 to 550-MeV PHOTONS IN CARBON, ALUMINIUM AND COPPER. Homma, S.; Itano, A.; Katsuura, K.; Maruyama, K.; Miyachi, T.; Nishikawa, K.; Okuno, H.; Sasaki, A.; Ukai, K.; Yamashita, N. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Sep 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

The total absorption cross sections of 250 to 550 MeV photons in carbon, aluminium and copper are measured using a tagged photon beam at the 1.3 GeV electron synchrotron of the Institute for Nuclear Study, University of Tokyo. The results are in agreement with the theoretical calculations for carbon and aluminium within the experimental accuracy of ± 1%. A small discrepancy between theoretical calculation and experiment is found for copper. (auth)

13034 (JINR-P10-8167) METHOD FOR THE SIMULATION OF MULTIPLE COULOMB SCATTERING DURING PASSAGE OF CHARGED PARTICLES THROUGH A SCATTERING MEDIUM SYSTEM WITH CONSIDERATION OF THE ENERGY LOSS. Berezhnev, S. F.; Emel'yanenko, G. A.; Zaimidoroga, O. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

An explicit form of the distribution of the variables characterizing the multiple Coulomb scattering during passage of charged particles through a scattering medium system was obtained with consideration of the energy loss. A simple method for the simulation of the distortion of the trajectory of the charged particles because of the multiple Coulomb scattering was proposed. (tr-auth)

13035 (PB-234489) INVARIANT IMBEDDING AND RADIATION DOSIMETRY. IX. Inverse Problem of Determining a Plane Source in a Finite Isotropically Scattering Target Slab. Bellman, R.; Fymat, A. L.; Ueno, S.; Vasudevan, R. (University of Southern California, Los Angeles (USA). Dept. of Electrical Engineering). May 1973. Contract AT(04-3)-113. 18p. (USC-113P-51). NTIS $4.00.

Considering a homogeneous, isotropically scattering target slab of optical thickness X, containing an internal plane emitting source. The aim here is to determine the distribution of the internal emitting source by measuring the angular distribution of the intensity of radiation emergent from the slab. (GRA)

13036 (UCRL-76141) OVERVIEW OF FUNDAMENTALS FOR RADIATION MEASUREMENTS. Maninger, R. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Oct 1974. 16p. (CONF-741208-1). Dep. NTIS $4.00.

From fourth measurement science conference; San Luis Obispo, California, USA (6 Dec 1974).

A brief descriptive overview is given of the basic concepts and factors involved in the origin, detection and measurement of radiation in the environment associated with the nuclear power industry. The detection of radiation always involves the interaction of radiation with matter in one way or another. Therefore, some elementary descriptions of matter are presented. Current concepts about the way radiation originates in radioactive matter are described and the main characteristics of the various kinds of radiation are reviewed. Then some details of the interactions of radiation with matter will be described. Finally, the applications of the interactions to make radiation sensors will be outlined. (auth)

13037 TRANSPORT AND DIFFUSION EQUATIONS IN TOROIDAL GEOMETRY. Pomraning, G. C.; Stevens, C. A. (Science Applications, Inc., La Jolla, CA). Nucl. Sci. Eng.; 55: No. 4, 359-367(Dec 1974).

The transport and diffusion equations appropriate for performing neutronic and photonic calculations in toroidal geometry are derived. This geometry is an important one in current conceptual designs of controlled thermonuclear reactors. It is shown that for an azimuthally independent problem the toroidal diffusion equation can be cast into the standard $r-\theta$ cylindrical equation by appropriately redefining the diffusion coefficient, absorption cross section, and external source. A Fourier expansion of the diffusion equation to obtain the theta dependence of the flux is shown to have the same truncation properties as those associated with the spherical harmonics method. A more useful expansion is one in inverse powers of the aspect ratio of the toroidal system. An idealized problem is solved analytically to obtain the first-order correction term arising from the overall curvature of the toroidal system. For an aspect ratio of three, typical of Tokamak fusion reactors now under consideration, this result indicates that local errors in the flux in excess of 15% can arise if the toroidal character of the geometry is neglected. (2 figures) (auth)

13038 DEEP ELECTRON THERAPY IN THE THORACIC REGION. P. 3. Dosimetric Investigations with Symmetrical Pendulum Irradiation Over the Lateral Thoracic Wall. Schnabel, K.; Oeftering, T.; Pereyra, J.; Kuttig, H. (Heidelberg Univ. (F. R. Germany). Strahlenklinik). Strahlentherapie; 148: No. 1, 69-73(Jul 1974). (In German).

6 figs.; 7 refs.

According to experimental investigations on the phantom, the realizable conditions of dose distribution under symmetrical electron pendulum irradiation over the lateral thoracic wall are described. For the experiments electron energies of 25, 30, and

42 MeV, pendulum angles of 120, 160, and 180 degrees and various positions of the axis to the median plane were used. The influence of the single parameters on the dose distribution are discussed. (auth)

13039 DEEP ELECTRON THERAPY IN THE THORACIC REGION. P. 4. Pendulum Irradiation with Asymmetrical Pendulum Angle. Kuttig, H.; Schnabel, K.; Scheffzek, M. J. (Heidelberg Univ. (F. R. Germany). Strahlenklinik). Strahlentherapie; 148: No. 1, 74-79(Jul 1974). (In German).

8 figs.; 9 refs.

The conditions of dose distribution under asymmetrical electron pendulum irradiation in the thoracic region are reported by the example of isodoses found experimentally on the phantom. The experiments were made with 25 and 42 MeV and pendulum angles of 90° (0°/95°) and 125° (-30°/+95°). The position of the axis was 7 cm from the anterior thoracic wall in the median plane or shifted 2 cm from this point to the depth, in the direction of the bisected angle. The influence of the single variables on the form of the isodoses and the radiation exposure of spinal marrow, pulmonary tissue, and skin are discussed. (auth)

13040 ENERGY LOSS OF SWIFT PROTON CLUSTERS IN SOLIDS. Brandt, W.; Ratkowski, A. (Department of Physics, New York University, New York, New York 10003); Ritchie, R.H. Phys. Rev. Lett. 33: No. 22, 1325-1328 (25 Nov 1974).

Energy-loss measurements in transmission experiments on carbon and gold foils with ~100-keV/nucleon H_2^+ and H_3^+ beams reveal that protons moving in spatially correlated clusters have effective charge numbers significantly larger than unity. The theory traces the origin of this effect to the coherent dynamic response of the target electrons due to the vicinage of particles in tight clusters and, in linear response approximation, predicts quantitatively the observed enhanced energy loss of proton clusters. (auth)

13041 PHYSICAL PROPERTIES OF COMPACT CYCLOTRON PRODUCED FAST NEUTRON FIELDS. Canada, T. R.; McDonald, J. C.; Freed, B. R.; Kuo, T. Y. T.; Laughlin, J. S. (Sloan-Kettering Cancer Center, New York). Radiat. Res.; 60: No. 2, 205-225(Nov 1974).

A number of physical properties of the fast neutron fields produced when 8 MeV deuterons or 23 MeV ^{3}He ions are incident upon a thick beryllium target have been measured. These include the relative angular dose distributions, the linear dose attenuation coefficients of steel, lead, and a polyethylene mixture, depth dependence of the total dose, the gamma-ray dose and the neutron planar fluence, and the distribution of dose in linear energy transfer at various positions in the fields. (auth)

13042 CENTRAL AXIS PERCENTAGE DEPTH-DOSE FOR HIGH ENERGY ELECTRONS. Pacyniak, J. M. (Veterans Administration Hospital, Hines, IL); Pagnamenta, A. Radiat. Res.; 60: No. 2, 342-346(Nov 1974).

A simple analytic formula for the central axis percentage depth-dose for high energy electrons in the 5-30 MeV range, penetrating homogeneous, low-Z materials ($Z \leq 20$), is derived. Both the intensity due to the primary beam as well as the additional dose due to the ionization electrons are taken into account. Field size variations are not considered at this stage, therefore, the present form only applies on the central axis. Empirical expressions for the position of the maximum dose and the range are used. The final expression is compared with available experimental results and excellent agreement, generally better than 5%, is found. (auth)

13043 RANGE AND STOPPING POWER EFFECTS OBTAINED FROM HIGH RESOLUTION RUTHERFORD BACKSCATTERING ANALYSIS OF IMPLANTED TARGETS. Williams, J. S. (Univ. of Salford, Eng.). Radiat. Eff.; 22: No. 3, 211-213(1974).

A report is presented on the preliminary analysis of 40 keV Pb^+-implanted Si crystals using a new glancing incidence backscattering geometry with a solid state detector, which is capable of measuring range profiles of heavy ions (above about 5 keV) in light substrates with a resolution approaching 20 Å. (auth)

13044 MEASUREMENTS OF W-VALUES FOR ALPHA PARTICLES IN TISSUE-EQUIVALENT GASES. Kemmochi, M. (Japan Defense Agency, Tokyo). Nippon Genshiryoku Gakkaishi; 16: No. 4, 206-213(Apr 1974). (In Japanese).

The W-values (average energy loss per ion pair) were measured by a modified Jesse method on four kinds of tissue-equivalent gases for α particles of ^{241}Am. The chart recorder followed by electrometer figuring in Jesse's apparatus was replaced by a "peak holder" circuit and pulse height analyzer, which made it possible to observe the pulse height distribution directly. The measurements resulted in 31.1 eV for Rossi's TE gas, 28.5 eV for Shonka's TE gas, 27.2 eV for propane-butane-air mixture and 27.1 eV for a new TE gas. Strickler's equation which has been used to predict the W-values of binary gas mixtures was modified into a form applicable to the case of mixtures of three or more gases. The estimated W-values of Rossi's TE gas and propane-butane-air mixture obtained with the extended equation agree well with the measured results. (auth)

13045 PENETRATION OF LOW ENERGY HELIUM IONS THROUGH COPPER THIN FILMS. Nomura, A. (Tohoku Univ., Sendai); Kanayama, M. Jap. J. Appl. Phys.; 13: No. 7, 1159-1160(Jul 1974).

13046 FLUORESCENCE OF AIR UNDER THE ACTION OF RELATIVISTIC ELECTRONS. Volovik, V. D.; Kobizskoi, V. I.; Petrenko, V. V.; Popov, G. F.; Fursov, G. L. Sov. At. Energy (Engl. Transl.); 34: No. 2, 170-171(Feb 1973).

Translated from At. Energ. (USSR); 34: No. 2, 130-131(Feb 1973).

When charged particles pass through matter, part of their energy goes to ionization and excitation of atoms and molecules of the medium. The dependence of ionization luminosity of air on electron energy from 20 to 1400 MeV was investigated in good geometry. The electron beam passed through a chamber with blackened walls; to eliminate possible detection of Cherenkov and transition radiation the direction of detection was chosen perpendicular to the beam, so that radiation from the side walls could not fall within the photomultiplier field of view. The light was recorded from all the electrons from a single accelerator pulse. Measurement accuracy was ±10%. The light intensity appeared to fall slightly as incident electron energy increased. The authors consider the experimental results to be in good agreement with calculations using the Moller formula for the dependence of the energy imparted to secondary electrons near the maximum cross section for atom excitation on the primary electron energy. (1 figure) (RWR)

13047 ENERGY LOSS OF 0.3-2.0-MeV ^{4}He IONS IN ALUMINUM. Feng, J.S. (California Institute of Technology, Pasadena, California 91109). J. Appl. Phys. 46: No. 1, 444-445 (Jan 1975).

The stopping power of aluminum for 0.3-2.0-MeV ^{4}He ions has been remeasured. The present results do not differ significantly from those previously reported by Porat and Ramavataram. (auth)

13048 STOPPING RATE AND ENERGY LOSS OF COSMIC RAY MUONS IN SAND. Hall, H.E. Jr.; Richmond, M.E. (Sam Houston State University, Huntsville, Texas 77340). J. Geophys. Res. 79: No. 35, 5503-5506 (10 Dec 1974).

The stopping rate of negative cosmic ray muons in an outcropping Miocene sand was determined by using scintillation techniques to be $(1.29 \pm 0.05) \times 10^{-5}$ exp(-0.103z) muon/cm^3 over the depth range of z from 3 to 11 m. This stopping rate is greater by a factor of 2-4 than previous emulsion measurements made in this depth range. The energy loss rate of cosmic ray muons over the same depth interval was determined to be nearly constant at 1.55 ± 0.06 MeV cm^2/g. (auth)

13049 WAVE VECTOR DEPENDENCE OF THE ELECTRON ENERGY LOSS FUNCTIONS OF GRAPHITE. Venghaus, H. (Univ., Hamburg). Phys. Status Solidi (b); 66: No. 1, 145-150(1 Nov 1974).

Electron energy loss measurements were performed on graphite single crystals with 55-keV electrons. From spectra taken with transferred momentum $\hbar q$ parallel to the c-axis and recorded for different absolute values of $|q|$ the wave vector dependent energy loss function $\mathrm{Im}[-1/\epsilon_{\|}(E, q)]$ was determined for $0 < E \lesssim 8$ eV and 0.25 Å^{-1} < $|q|$ < 0.75 Å^{-1}. Apart from the dispersion of the energy loss maximum in the 5- to 6-eV region the main feature of $\mathrm{Im}[-1/\epsilon_{\|}(E, q)]$ is the appearance of a band gap E_g, increasing from $E_g \ll 1$ eV for $|q| = 0$ up to $E_g \approx 1$ eV for $|q| \approx 0.7$ Å^{-1}. Additional measurements made with transferred momentum $\hbar q$ perpendicular to the c-axis confirmed the dispersion of the π-plasmon, exhibiting an anisotropy for large wave vectors and different orientation of the latter within the layer planes of graphite. (auth)

13050 NUCLEAR ENERGY LOSS AND SCATTERING OF IONS PENETRATING THIN LAYERS OF MATTER. Skoog, R. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik). Comput. Phys. Commun.; 7: No. 7, 392-400(Jul 1974).

NELAS calculates the nuclear (elastic) energy losses and scattering distributions of initially monoenergetic and perfectly collimated ions penetrating a thin layer of matter. The distributions are obtained by Monte Carlo simulation using the reduced differential cross section in the form given by Lindhard and coworkers. The only assumptions made for the energy loss part of the calculation is that the collisions are perfectly elastic. (auth)

Radiation Protection Standards

Refer also to abstracts 11657, 13055, and 13447.

13051 (AED-CONF-73-546-001) CONSTRUCTIONAL REQUIREMENTS FOR THE ERECTION AND OPERATION OF X-RAY EQUIPMENT. Jensen, F. (Mueller (C.H.F.) G.m.b.H., Hamburg (F. R. Germany)). 1973. 10p. (In German). INIS.

From 14th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Wuerzburg, Germany (16 Nov 1973).

The provisions of the X-Ray Ordinance, affecting the planning, design and assembly of x-ray equipment are summarized and discussed. The phrasing of the relevant provisions of the Ordinance proves to be rather inspecific, of a more general nature. Detailed regulations or technical specifications which could be of help with a view to practical radiation protection through appropriate constructional measures are missing. This leaves a margin for interpretations which might lead to uncertainties. Practical measures to be taken as a consequence of the requirements laid down in the Ordinance are, e.g., the publication of the revised version of DIN 6812 (radiation protection regulations governing the construction and mounting of x-ray equipment up to 300 kV), which is discussed in detail. (GE)

13052 (INIS-mf-1330) BASIC STANDARDS FOR RADIOLOGICAL PROTECTION. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro. Departamento de Fiscalizacao de Material Radioativo). 1973. 100p. (In Portuguese). INIS.

Brazilian basic standards for radiological protection and safety are presented. Maximum permissible doses, control of personnel, RBE, and several contamination levels are presented, following, in general way, the international convention. (INIS)

13053 REGULATIONS CONCERNING THE IMPLEMENTATION OF THE X-RAY ORDINANCE. 2. Notification of the BMA and the BMJFG as of March 15, 1974. Arbeitsschutz (Cologne); No. 6, 2-24 (Jun 1974). (In German).

3 figs.; 2 tabs.; 8 refs.

Presented are: A) Regulations concerning methods and scope of measurements of personal doses according to paragraph 40 of the X-Ray Ordinance. B) Regulations governing evaluation of the personal dose in accordance with the X-Ray Ordinance. C) Regulations concerning the keeping of records as stipulated in paragraph 29 of the above Ordinance. D) Regulations with regard to follow-up measurements in accordance with paragraph 13 of the Ordinance. E) Instructions concerning radiation protection in maintenance and repair shops for television devices. F) List of courses and the like on radiation protection, which shall be approved as instruction courses prior to the coming into force of the X-Ray Ordinance. (GE)

Radiation Source Calibration and Standardization

Refer also to abstracts 11317 and 11322.

Shielding Calculations and Experiments

Refer also to abstracts 12189 and 12760.

13054 (CONF-741109-2) COMPUTER CODES AND DATA AVAILABLE FROM THE RADIATION SHIELDING INFORMATION CENTER. Trubey, D. K.; Maskewitz, B. F.; Roussin, R. W. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 5p. Dep. NTIS $4.00.

From international symposium on radiation physics; Calcutta, India (30 Nov 1974).

The Radiation Shielding Information Center (RSIC) is a technical institute serving the international shielding community. It acquires, selects, stores, retrieves, evaluates, analyzes, synthesizes, and disseminates information on shielding and ionizing radiation transport. The major activities include: (1) operating a computer-based information system and answering inquiries on radiation analysis, (2) collecting, checking out, packaging, and distributing large computer codes, and evaluated and processed data libraries. The data packages include multigroup coupled neutron-gamma-ray cross sections and kerma coefficients, other nuclear data, and radiation transport benchmark problem results. (auth)

13055 (CONF-741109-3) DEVELOPMENT OF RADIATION SHIELDING STANDARDS IN THE USA. Trubey, D. K. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 8p. Dep. NTIS $4.00.

From international symposium on radiation physics; Calcutta, India (30 Nov 1974).

The American Nuclear Society (ANS) is a standards-writing organization-member of the American National Standards Institute (ANSI). The ANS Standards Committee has a subcommittee denoted ANS-6, Shielding, whose charge is to establish standards in connection with radiation shields, to provide shielding information to other standards writing groups, and to prepare recommended sets of shielding data and test problems. This paper is a progress report of this subcommittee. (auth)

13056 (JINR-P16-8177) SPECTRAL-ANGULAR DISTRIBUTION OF HIGH ENERGY NEUTRONS IN AlO_2 SHIELDS (FLAT MONODIRECTIONAL NEUTRON SOURCE ON THE BOUNDARY OF A SEMI-INFINITE SHIELD). Aleinikov, V. E.; Kryuchkov, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A method is described for the calculation of the spectral-angular distribution of neutrons with energies 20 MeV $\leq E \leq$ 400 MeV in shields for cases of flat monodirectional neutron sources on the boundary of a semi-infinite medium. The results of calculations for AlO_2 shields are reported. (tr-auth)

13057 (ORNL-TR-2874) MERCURE-4: A THREE-DIMENSIONAL MONTE CARLO PROGRAM FOR THE INTEGRATION OF STRAIGHT-LINE ATTENUATION POINT KERNELS. Devillers, C.; Dupont, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service d'Etudes des Reacteurs et de Mathematiques Appliquees). Jul 1974. Translation by E. G. Silver of CEA-N-1726. 40p. Dep. NTIS $5.00.

Most computer codes using the point kernel method employ a "discretization" technique to integrate the kernel over the energy and space domain of the distributed source. This domain is decomposed into energy groups and spatial zones. MERCURE-4 uses the multigroup approximation, but the energy group division can be as fine as desired without appreciable effect on the calculation time. Spatial discretization is also employed, but it is used only to calculate the table of probability, and the calculation time is not proportional to the number of zones. The MERCURE-4 program calculates the build-up factors for mixtures, and it determines for each energy group the equivalent atomic number of the mixture and does a Z interpolation from the library of build-up factors for the single elements. Principal characteristics of the program described are the attenuation kernel, geometry description, distributed source, and basis of the method of integration. The calculation of the integral, formulation of the importance functions, calculation and iteration of the importance functions, and precision tests are discussed. A fairly detailed section on running the program is given. It is written in FORTRAN IV for the IBM 360/91. As a sample problem, a shipping cask for irradiated fuel is calculated. (4 figures) (RWR)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 12490, 13070, and 13485.

13058 (KFKI-74-34) COLLECTION OF SCIENTIFIC PAPERS IN COLLABORATION OF JOINT INSTITUTE FOR NUCLEAR RESEARCH, DUBNA, USSR AND CENTRAL RESEARCH INSTITUTE FOR PHYSICS, BUDAPEST, HUNGARY. Algorithms and Programs for Solution of Some Problems in Physics. Varga, L.; Zhidkov, E. P.; Makarenko, G. I.; Nemeth, G. (eds.). (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Sep 1974. 235p. (In Russian and English). Dep. NTIS (US Sales Only) $14.75.

Application of the generalized inverse matrix method to the least squares parameter estimation is described. The method can be applied with success to solve "ill-conditioned" problems since it effectively removes the matrix singularity difficulties in the least squares problems. (auth)

13059 DECOMPOSITION OF TRANSFORMATION MATRICES INTO SUMS OF PRODUCTS OF 6j COEFFICIENTS. Kiselev, A. A.; Bandzaitis, A. A. (Inst. of Physics and Mathematics, Vilnyus, USSR). Liet. Fiz. Rinkinys; 14: No. 1, 11-18(1974). (In Russian).

The expressions for diagrams, which correspond to 12j- and 15j-coefficients, in terms of sums of products of 6j-coefficients with minimal phase factors are taken. The number of terms in the sums of different form is discussed. (auth)

13060 HIGHER ORDER VARIATIONAL PRINCIPLES AND PADE APPROXIMANTS FOR LINEAR FUNCTIONALS. Conn, R. W. (Univ. of Wisconsin, Madison). Nucl. Sci. Eng.; 55: No. 4, 468-470(Dec 1974).

The relationship between higher-order variational principles for linear functionals of the solution to an inhomogeneous equation and Padé approximants for the same functional is shown. This leads to a deeper understanding of these higher-order principles. Further, it is noted that in certain cases the Roussopoulos function can yield divergent results while using the Ritz procedure, shown to be equivalent to forming Padé approximants for the functional of interest, gives a generalized Schwinger normalization independent variational principle that can yield finite and convergent results. (auth)

13061 ESSENTIALLY NONLINEAR ONE-DIMENSIONAL MODEL OF CLASSICAL FIELD THEORY. Takhtadzhyan, L. A.; Faddeev, L. D. (Mathematical Inst., Leningrad). Teor. Mat. Fiz.; 21: No. 2, 160-174(Nov 1974). (In Russian).

It is shown that the equation $u_{tt} - u_{xx} + \sin u = 0$ with the boundary condition $u(x,t) \to 0 \pmod{2\pi}$ when $|x| \to \infty$, which describes the classical field with essentially nonlinear interaction is a completely integrable Hamiltonian system. The results obtained are interpreted in terms of particles associated with the field u(x,t). (auth)

13062 ON THE DIFFRACTION OF DENSE ELECTRON BEAMS IN QUANTUM MECHANICS. Datsev, A. B.; Rusev, D. G. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). Compt. Rend. Acad. Bulg. Sci.; 26: No. 5, 607-610(1973).

A new conception of quantum mechanics was given earlier. A nonlinear integral-differential equation, called probability equation, was proposed as a generalization of Schrödinger's equation. It was shown that it can explain some experimentally observed phenomena which do not follow from Schrödinger's equation, for example the expansion of the dense electron beam. A simple diffraction problem with dense electron beams, which is differentially treated with the two equations, is examined. A lense electron beam with constant velocity and constant intensity of the beam current is falling on a plane screen, nontransparent for electrons, with a rectangular opening. The screen is perpendicular to the direction of the beam. There is a second screen, parallel to the first, absorbing the electrons. Two concrete cases are examined: I. $I = 50\ \mu A$, $\sigma = 10^{-2}$ cm^2, accelerating voltage 500 V; II. $I = 100$ mA, $\sigma = 10^{-4}$ cm^2, accelerating voltage 1 kV. The result is that in the two cases the diffraction picture differs. In case I (small density) a Schroedinger equation describes a diffraction picture which has been checked experimentally. In case II this is not enough, and the generalized probability equation must be used. It is obvious that suitable experiments are of principal importance for a comparison of the results which follow from Schroedinger's equation and from the generalized probability equation. (auth)

13063 NUMERICAL SOLUTION OF SCHROEDINGER'S RADIAL EQUATION. Hajj, F. Y. (National Council for Scientific Research, Beirut, Lebanon); Kobeisse, H.; Nassif, N. R. J. Comput. Phys.; 16: No. 2, 150-159(Oct 1974).

Higher order difference schemes are considered for the numerical solution of Schroedinger's radial equation. They are a family of difference equations which are extensions of the well known Numerov difference equation and give highly convergent approximate solutions, the least being $O(h^6)$ compared to $O(h^4)$ in the Numerov equation. An algorithm to find eigenvalues and eigenfunctions using one-directional "shooting" is discussed. The stability and convergence of these schemes are also discussed. An example and numerical results are given, and the order of convergence which is estimated from the results is found to be close to the theoretical value. (auth)

13064 ALGEBRAIC FORMULAS FOR THE COMPUTATION OF THE RICCI TENSOR. Pachner, J. (Univ. of Regina, Saskatchewan). Can. J. Phys.; 52: No. 22, 2210-2214(15 Nov 1974).

Formulas for an easy computation of the Ricci tensor are deduced under the assumption that 7 components of the metric tensor, g_{ik}, g_{44}, depend on all four coordinates, $g_{14} = g_{24} = 0$, and $g_{34} = -A(x^3,x^3)g_{44}$. This kind of metric imposes no requirement at all upon the geometrical symmetry in a particular system of comoving coordinates. The formulas can be used without loss of generality also in all other coordinate systems in which the g_{14} either vanish or depend on the coordinates as expressed above (for instance, in the synchronous reference frame of Landau and Lifshitz). (auth)

13065 MANUAL FOR SCHOONSCHIP. A CDC 6000/7000 Program for Symbolic Evaluation of Algebraic Expressions. Strubbe, H. (European Organization for Nuclear Research, Geneva (Switzerland)). Comput. Phys. Commun.; 8: No. 1, 1-30(Aug 1974).

SCHOONSCHIP is a high speed program which is capable of evaluating expressions of the form: (A1 + B1 + ...)*(A2 + B2 + ...)*...+(AA1 + BB1 + ...)*..., where * denotes multiplication and where A1, B1, etc., may be products of numbers, algebraic symbols, vectors, functions, etc., or further expressions enclosed in brackets. Moreover, an elaborate set of substitutions and commands is provided which allows one to perform most of the commonly required algebraic manipulations. Many special operations which are used in high energy physics calculations are built in as well. Its results can be given again as input for further processing, hence using the computer as a writing pad. Output, compatible with FORTRAN, can be obtained on punched cards and inserted directly into a numerical program. (auth)

Quantum Field Theories

Refer also to abstracts 12470, 12471, 12595, 12628, 12636, 12637, 12641, 12690, 12962, 13096, 13107, and 13108.

13066 (JINR-E2-8106) STOCHASTIC PSEUDOFIELDS AND THE QUANTUM FIELD THEORY. Garczynski, W. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The notions of regular and generalized stochastic pseudofields are discussed. The generating functionals of the τ-functions for various quantum fields are expressed in terms of these pseudofields and their probabilistic characteristics. (auth)

13067 (JINR-E2-8107) APPROXIMATION FOR GENERATING FUNCTIONAL OF TAU-FUNCTIONS BASED ON LIMIT THEOREM FOR STOCHASTIC PSEUDOPROCESSES. Garczynski, W. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

A limit theorem for stochastic processes is suitably modified and applied to the case of relativistic pseudoprocesses. It permits one to construct a natural approximation for a generating functional of τ-functions of a scalar neutral field. Generalization to other fields is possible as well. (auth)

13068 ON THE EXACT SOLUTIONS OF THE WICK–ROTATED FERMION–ANTIFERMION BETHE–SALPETER EQUATION. zum Winkel, D. (Deutsches Elektronen–Synchrotron DESY, Hamburg, West Germany). J. Math. Phys. (N.Y.) 16: No. 1, 93-95 (Jan 1975).

Exact solutions of the fermion–antifermion Bethe–Salpeter equation with harmonic kernels are given for bound states with zero mass. The algebraic structures of these BS amplitudes is analyzed. (auth)

13069 LORENTZ COVARIANCE OF THE YUKAWA$_2$ QUANTUM FIELD THEORY. McBryan, O.A. (Department of Mathematics,

University of Toronto, Toronto, Canada M5S 1A1); Park, Y.M. J. Math. Phys. (N.Y.) 16: No. 1, 104-110 (Jan 1975).

We prove Lorentz covariance of the field algebras in the Yukawa$_2$ quantum field theory, thus completing the verification of the Haag–Kastler axioms for this model. We also study the energy–momentum tensor of the theory. In particular, we prove an estimate of the form $P(f)^2 \leq \text{const}\,(H(g)+I)^2$ dominating local momenta by local Hamiltonians. Most of the results are a consequence of this estimate. These methods apply also to the $(\phi^4)_2$ model. (auth)

13070 TIME OPERATORS, POSITION OPERATORS, DILATATION TRANSFORMATIONS AND VIRTUAL PARTICLES IN RELATIVISTIC AND NONRELATIVISTIC QUANTUM MECHANICS. Almond, D. J. (Southhampton Univ., Eng.). Ann. Inst. Henri Poincare, Sect. A; 19: No. 2, 105-170(1973).

The irreducible representations of the Weyl group are interpreted as virtual (off-mass-shell) relativistic particles. The irreducible representations are labelled by two invariant operators: the on-mass-shell mass, M, and $-W^2/P^2$, which, for a particle with timelike four-momentum is just $s(s+1)$ where s is the spin of the particle. The fact that the Weyl group Lie algebra contains one generator more than that of the inhomogeneous Lorentz group allows one to construct a time operator as well as the usual four-momentum, angular momentum, and position operators. The analogous situation in nonrelativistic quantum mechanics is studied. The relevant group is the group of inhomogeneous Galilei transformations and dilatations $(t',x') = \lambda^2 t, \lambda x$, which bear the same relation to the nonrelativistic Schroedinger equation as do the dilatations $x' = \lambda x$ to the Klein-Gordon equation. The irreducible representations of this group is interpreted as describing virtual nonrelativistic particles. Two kinds of irreducible representations are found, corresponding to Bargmann's ray representation of the Galilei group and Inonu and Wigner's class II true representation of the Galilei group. The first kind is just a virtual massive nonrelativistic particle of mass m and spin s, and is the nonrelativistic limit of the timelike four-momentum irreducible representation of the Weyl group. The second kind is labelled by a helicity, λ, and is the nonrelativistic limit of a spacelike four-momentum irreducible representation of the Weyl group. (auth)

13071 STATISTICAL MECHANICS OF THE NONRELATIVISTIC ZACHARIASEN MODEL. Garvey, R.H.; Shaw, P.B. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802). Phys. Rev. D 10: No. 8, 2361-2373 (15 Oct 1974).

The statistical mechanics of the nonrelativistic Zachariasen model is studied for the purpose of clarifying a mechanism proposed some years ago by Omnès to effect a phase transition in hot, dense matter with zero net baryon number from a homogeneous thermodynamic state to one with local inhomogeneities in the baryon number density. The model contains B and $\bar{B}$ particles, which play the role of baryons and antibaryons, respectively, and A particles, which play the role of mesons. The A particles are coupled in the Hamiltonian to B $\bar{B}$ pairs through virtual annihilation and creation. The Helmholtz free energy is calculated in a virial expansion for the cases in which real B $\bar{B}$ pair annihilation and creation is (1) important enough to achieve full thermodynamic equilibrium, and (2) unimportant enough so that over an appropriate time scale the A particles and B $\bar{B}$ pairs are independent of one another. To analyze case (2) a unitary transformation is made on the original Hamiltonian which completely renormalizes the A–particle rest energy and transforms the original interaction into an infinite sum of potentials that act within groups containing increasing numbers of particles. We then study case (2) by dropping potentials that involve real creation and annihilation. Within the context of the virial expansion we conclude that no Omnès transition occurs for case (1), while such a transition is possible for case (2). (auth)

13072 POSSIBILITY THAT MASSLESS YANG–MILLS FIELDS GENERATE MASSIVE VECTOR PARTICLES. Smit, J. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. D 10: No. 8, 2473-2490 (15 Oct 1974).

It is examined whether the massless Yang–Mills field theories can describe massive vector particles which have a common mass. The nonzero mass is supposed to be accompanied by poles in vertex functions. It is demonstrated that such poles can be consistent with the Ward identities. Homogeneous linear integral equations describing approximately the residues of these poles are shown to have asymptotic nontrivial solutions. (auth)

13073 VACUUM POLARIZATION IN HOMOGENEOUS MAGNETIC FIELDS. Tsai, W. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. D 10: No. 8, 2699-2702 (15 Oct 1974).

The lowest–order vacuum polarization in homogeneous magnetic fields is calculated exactly, using a "momentum" representation of the electron Green's function obtained by Schwinger in 1951. (auth)

13074 FORMULATION OF ABELIAN GAUGE THEORIES WITHOUT REGULATORS. II. Lowenstein, J.H.; Zimmermann, W. (Department of Physics, New York University, New York, New York 10003); Weinstein, M. Phys. Rev. D 10: No. 8, 2500-2513 (15 Oct 1974).

A new method of renormalizing Abelian gauge theories without regulators is developed in this series of papers. In the present part infrared problems are avoided by modifying the Lagrangian such that all masses are nonvanishing. It is shown that conventional renormalization of the classical Lagrangian leads to anomalies of the current. A modified renormalization scheme is proposed and shown to imply the classical form of partial current conservation and the desired Ward identities. Differential vertex operations are studied which will be used in part III of this series for carrying out the required zero–mass limits. (auth)

13075 FORMULATION OF ABELIAN GAUGE THEORIES WITHOUT REGULATORS. III. Lowenstein, J.H. (Department of Physics, New York University, New York, New York 10003); Schroer, B. Phys. Rev. D 10: No. 8, 2513-2529 (15 Oct 1974).

Parametric differential equations are derived which allow one to study the pre–Higgs and Higgs limits of the explicitly broken pre–Higgs model, as well as its short–distance behavior and gauge dependence. It is shown that all physical scattering amplitudes in the pre–Higgs and Higgs models can be expressed in terms of the Green functions of the conserved current. A gauge–invariant composite field is defined which serves as interpolating field for the heavy spin–one particles in the Higgs model. Reduction formulas are obtained which make transparent the principal features of the Higgs phenomenon. (auth)

13076 ASYMPTOTIC SYMMETRY. Lee, B.W. (National Accelerator Laboratory, Batavia, Illinois 60510); Weisberger, W.I. Phys. Rev. D 10: No. 8, 2530-2534 (15 Oct 1974).

We discuss the deep Euclidean behavior of Green's functions in models in which symmetries are broken spontaneously or by "soft" operators. Our proof that the Green's functions approach their symmetric values in the deep Euclidean region uses the Callan–Symanzik equation in a way which avoids relying on order–by–order power counting for the scalar tadpole insertions. The vacuum expectation value of the scalar field appears in the Callan–Symanzik equation as an additional coupling constant; the solution of the equation introduces a momentum–dependent effective vacuum expectation value. We discuss theories with or without gauge invariance of the second kind. (auth)

13077 LAGRANGIAN AND HAMILTONIAN FORMULATION OF RELATIVISTIC PARTICLE MECHANICS. Marnelius, R. (Institute of Theoretical Physics, Fack, S.–402 20 Göteborg 5, Sweden). Phys. Rev. D 10: No. 8, 2535-2553 (15 Oct 1974).

It is shown that any (relativistic) action–at–a–distance theory formulated in terms of a (relativistically invariant) Fokker action, which is invariant under any change of the world–line parameter, also can be given a Lagrangian formulation. The parametrization invariance makes it possible to introduce a common parameter which also can be identified with time. The resulting Lagrangians are nonlocal in time and therefore the applicability of the action principle requires a generalized variation method which is developed here. The resulting generators are expected to generate the corresponding variations in a Poisson–bracket sense, i.e., a Hamiltonian formulation of the theory is expected to exist. However, in order to check this it is necessary to (formally) solve the equations of motion, as one needs Poisson brackets for unequal time due to the nonlocality of the generators. But since the equations of motion themselves are nonlocal in time, the Newtonian initial data will not yield a unique solution. Thus, in order to retain the Newtonian degrees of freedom one needs a selection principle as a subsidiary condition. Such a principle has been proposed which states that one has to choose the solution which has a nonrelativistic limit. In the case of a general vector interaction the class of solutions which is obtained by an iterative method (which starts from straight lines) is considered. These solutions are uniquely determined by the Newtonian initial data, but they are applicable only to scattering processes. By choosing the asymptotic straight lines as canonical variables it is explicitly shown that the Poincaré generators fulfill the Lie algebra of the Poincaré group and that the physical positions transform as Lorentz vectors. It is also shown that the physical positions cannot be chosen as canonical variables. Quantization is discussed and a general argument is put forth which states that the above solutions cannot be quantized by imposing the canonical commutation relations on the canonical variables. (auth)

13078 MASSLESS ELECTRODYNAMICS IN THE ONE–PHOTON–MODE APPROXIMATION. Adler, S.L. (Institute for Advanced Study, Princeton, New Jersey 08540). Phys. Rev. D 10: No. 8, 2399-2421 (15 Oct 1974).

We discuss single–fermion–loop vacuum–polarization processes in massless quantum electrodynamics in the one–photon–mode approximation, in which the fermion self–interacts (to all orders in perturbation theory) by the exchange of virtual photons in a single

virtual—photon eigenmode. The isolation of one photon mode is made possible by using the O(5) —covariant formulation of massless QED introduced in two earlier papers, in which the photon wave operator has a discrete, rather than a continuous, spectrum. The amplitude integral formalism introduced previously expresses the one—mode radiative—corrected vacuum polarization in terms of the uncorrected vacuum amplitude in the presence of a one—mode external field. By exploiting the residual SO(3) × O(2) symmetry of the one—mode external—field problem, which permits separation of variables, we reduce the external—field problem to a set of two coupled ordinary first—order differential equations. We show that, when the two independent solutions to these equations are suitably standardized, their Wronskian gives (up to a constant factor) the external—field—problem Fredholm determinant. We study the distribution of zeros and asymptotic behavior of the Fredholm determinant, relate these properties to the coupling—constant analyticity of the one—mode vacuum polarization, and conclude by giving a brief list of unresolved questions. (auth)

13079 EXACT DIAGONALIZATION OF THE DIRAC HAMILTONIAN IN AN EXTERNAL FIELD. Johnson, J.E.; Chang, K.K. (Physics Department, University of South Carolina, Columbia, South Carolina 29208). Phys. Rev. D 10: No. 8, 2421-2427 (15 Oct 1974).

The Hamiltonian of a Dirac particle in an arbitrary electromagnetic field is exactly diagonalized by a unitary transformation generalizing previous work which was restricted to time—dependent fields. A very simple form is found for the covariant Heisenberg equations which manifestly exhibits the classical correspondence. These results are obtained in a manifestly covariant form using a previously proposed proper—time quantum mechanics with subsequent specialization to a mass eigenstate resulting in the usual theory. The simple theorem used for this diagonalization is also applied to other transformations for helicity and the free—particle Hamiltonian. The source of difficulty in obtaining these results without an intermediate use of proper—time theory is shown. (auth)

13080 EFFECTIVE ACTION FOR COMPOSITE OPERATORS. Cornwall, J.M. (Department of Physics, University of California, Los Angeles, California 90024); Jackiw, R.; Tomboulis, E. Phys. Rev. D 10: No. 8, 2428-2445 (15 Oct 1974).

An effective action and potential for composite operators is obtained. The formalism is used to analyze, by variational techniques, dynamical symmetry breaking and coherent solutions to field theory. A Rayleigh—Ritz procedure is introduced which replaces arbitrary variations with parametric variations. Previously unsolved nonlinear equations become, in the Rayleigh—Ritz approximation, solvable algebraic equations. (auth)

13081 THEORY OF QUANTUM KINETIC PROCESSES IN STRONG ALTERNATING FIELDS. Amirov, R. Kh.; Smolyanskii, S. A.; Shekhter, L. Sh. (Saratov State Univ., USSR). Teor. Mat. Fiz.; 21: No. 2, 247-257(Nov 1974). (In Russian).

In the framework of D. N. Zubarev's nonequilibrium statistical operator method and in the weak interparticle interaction approximation, the generalized quantum kinetic equation of the nonmarkovian type is obtained for the nonstationary inhomogeneous system. As an example, the system of charged Fermi particles in the external nonstationary inhomogeneous electric field is considered. The influence of the external field on the process of particles collision is studied, and one succeeds in writing down the collision integral without assumption about the weakness of the external field. The kinetic equation obtained represents the quantum-mechanical analog of V. P. Silin's kinetic equation for quickly changing processes. (auth)

13082 PERTURBATION APPROACH TO THE FIELD THEORY, DRESSING AND DIVERGENCES. Shirokov, M. I. (Joint Inst. for Nuclear Research, Dubna, USSR); Visinescu, M. M. Rev. Roum. Phys.; 19: No. 5, 461-472(1974).

The perturbation approach to "dressing" field theory proposed by L. D. Faddeev is considered. It is shown that in the case of Yukawa interaction ($\lambda\bar{\psi}\gamma^5\varphi$) the "dressing" procedure leads to an interaction Hamiltonian with additional divergences which are not present in the S-matrix and cannot be removed by the usual renormalization rules. The possibility of removing these divergences is pointed out by adequately modifying the "dressing" method. (auth)

13083 NORMS OF MULTIMASS STATES IN RELATIVISTIC QUANTUM FIELD THEORY. Palmer, R.; Takahashi, Y. (Univ. of Alberta, Edmonton). Can. J. Phys.; 52: No. 20, 1988-1994 (15 Oct 1974).

The problem of the appearance of negative norm states in multimass models is examined. It is shown explicitly how the bound state with the same quantum numbers as the elementary meson can acquire the positive norm. It is inferred from the argument that the multi-mass system of dynamical origin can be quantized without the negative norm, contrary to the multimass system of kinematical origin. (auth)

13084 ESSENTIALLY NONLINEAR FIELDS AND VACUUM POLARIZATION. Blokhintsev, D. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Teor. Mat. Fiz.; 21: No. 2, 155-159(Nov 1974). (In Russian).

The behavior of the energy density for interacting fields at large gradients is shown to be in agreement with the classification of the fields according to their renormalizability. The vacuum polarization resulting in fields with bounded derivatives is considered. (auth)

13085 IMPORTANCE FOR THEORY AND EXPERIMENTAL METHODS OF RESEARCH INTO FAST ELECTRON FIELD. Horak, Z.; Novak, R. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)). Elektrotech. Obz.; 62: No. 12, 705-711(Dec 1973). (In Czech).

Well-known formulas issuing from classical and relativistic electrodynamics for the electromagnetic field of fast charged particles were not yet verified by direct measurement with sufficient accuracy. Neither were deviations from the Biot-Savart law established for electron beams accelerated to an energy of up to 30 MeV. The importance is stressed for theory of determining the deviations. Original experiments are described confirming that the field of fast electrons differs from the Biot-Savart field, this in agreement with theory. The experiments can be regarded as the first experimental ascertainment of the existence of a relativistic effect of the 4th order. (auth)

13086 QUANTUM EFFECTS IN A STRONG ELECTROMAGNETIC FIELD. Lyul'ka. Zh. Eksp. Teor. Fiz.; 67: No. 5, 1638-1646(Nov 1974). (In Russian).

Photon emission by electrons and pair production are studied in an intense field of a plane monochromatic wave of arbitrary elliptic polarization and also in the field of two linearly polarized waves, with mutually perpendicular polarizations, moving in the same direction. Expressions for the probabilities of the processes are obtained and numerical calculations are carried out for concrete values of the parameters of the problem. Some characteristic features of the total probabilities on variation of the external field frequency are discussed. (auth)

13087 RECOIL EFFECT IN A STRONG RESONANT FIELD. Kazantsev, A. P. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 5, 1660-1666(Nov 1974). (In Russian).

In a strong resonant field the recoil effect is, generally speaking, of a classical nature: under the action of a gradient force the atom moves along a certain classical trajectory. A special case arises only in the vicinity of frequencies near point resonance. Due to saturation the mean gradient force in this case vanishes and quantum fluctuations of the force should be taken into account. In this case a correlation between the induced dipole moment and velocity of the atom arises. It is shown that the atomic beam incident on the vacuum—resonant field interface experiences birefringence. Some features of resonance fluorescence in an inhomogeneous field and of heating of atoms in a nonstationary resonance field are discussed. (auth)

13088 CRITICISM AT SOME ATTEMPTS TO FIND LOGICAL INCONSISTENCY IN THE SPECIAL THEORY OF RELATIVITY. Gordeyev, G. V. (AN SSSR, Leningrad. Fiziko-Tekhnicheskij Inst.). Phys. Lett., A; 49: No. 5, 400-402(7 Oct 1974).

Some attempts to find logical inconsistency in the special theory of relativity are considered. It is shown that all these attempts have failed, and that the Doppler effect does not contradict the Einstein postulate. (auth)

13089 ON THE COVARIANT EQUATIONS OF MOTION WITH EXPLICIT RADIATION DAMPING. I. General Formalism. van Weert, C. G. (Amsterdam Univ. (Netherlands). Instituut voor Theoretische Fysica). Physica; 76: No. 2, 345-363(1 Sep 1974).

On the basis of the conservation of energy-momentum and angular momentum the general form of the equations of motion of a point particle possessing an arbitrary number of multipole moments is established. It is seen that the asymptotic condition of uniform motion in the remote past plays an essential role in the derivation. The effects of the radiation reaction are taken into account in the form of a radiation reaction force and torque which are zero if and only if the particle does not radiate. It is shown that the infinities associated with a point-particle model may be subtracted so that the energy-momentum and inner angular momentum of the particle become finite. (auth)

Gravitation and General Relativity

13090 CERTAIN SPECIAL FEATURES OF THE GRAVITATIONAL METRIC OF SPHERICAL SYMMETRY AND GEODESIC

TYPE. Kale, P. P. (Univ. of Poona). Indian J. Pure Appl. Math.; 3: No. 6, 1108-1117(Nov 1972).

Perfect fluid distributions with spherical symmetry are discussed with the metric of the form $ds^2 = d\tau^2 - X^2(\rho,\tau)d\rho^2 - Y^2(\rho,\tau)d\Omega^2$. It is shown that if $X = \partial Y/\partial\rho$, only a de Sitter type solution is possible while, if $X = \partial Y/\partial\rho/\sqrt{n + (\partial Y/\partial\tau)^2}$, physically possible perfect fluid distributions exist with the invariant $J = 0$. Further a transform of Schwarzschild's interior solution into the geodesic form is given, as a sequel to the transform of Schwarzschild's external solution in the geodesic form, already known. (auth)

13091 COMPOSITE FIELD EXHIBITING PLANE SYMMETRY IN EINSTEIN'S UNIFIED FIELD THEORY. Tiwari, R.; Kashyap, J. N. S. (Banaras Hindu Univ., India). Indian J. Pure Appl. Math.; 3: No. 6, 1250-1255(Nov 1972).

A static plane symmetric field is considered and the exact solution of its field equations in Einstein's unified field theory is obtained. (auth)

13092 COVARIANT CONSERVATION THEOREM IN GENERAL RELATIVITY. Ging, J. L. (Clemson Univ., SC); Ferrell, T. L. Nuovo Cim.; 24B: No. 2, 189-196(11 Dec 1974).

The transformation of the Hamilton action integral of general relativity under infinitesimal coordinate transformations is used to derive a tensorial conservation theorem for the gravitational field. The total gravitational field is split into two parts: a "background" field (assumed to be given) and a perturbative part. The resulting conservation theorem is exact, covariant and of the Poynting type, i.e., only first derivatives of the perturbative field appear in it. (auth)

13093 MOTION OF PARTICLES IN GENERAL RELATIVITY BEYOND THE GEODETIC APPROXIMATION. Ferrell, T. L.; Ging, J. L. (Clemson Univ., SC). Nuovo Cim.; 24B: No. 2, 197-241(11 Dec 1974).

A tensorial surface integral relation which is equivalent to the Einstein field equations for empty space is used to derive the equation of motion of a finite-mass monopole correct to terms proportional to the square of the mass of the particle. The resulting equation of motion is covariant under both continuous transformations of the four coordinates and also under singular (mass-dependent) coordinate transformations. No infinities occur in the calculations. (auth)

13094 GRAVITATIONAL FIELD OF A FREELY MOVING MASS. Salzman, F. (Univ. of Massachusetts, Dorchester). Nuovo Cim.; 24B: No. 2, 157-188(11 Dec 1974).

A definition of a freely moving mass in general relativity is proposed based upon properties of the analogous motion in special relativity. Coordinate ambiguities can, to a large extent, be removed with the use of "invariant" quantities which play the role of "gauge invariants" in general relativity under coordinate transformations which do not change the frame of reference. The gravitational "force" which a freely moving source, taken to be a Schwarzschild mass, exerts on a test mass momentarily at rest, or on another mass momentarily at rest asymptotically far away is calculated, showing that two-body effects can be important even in the case of a "test" mass. The definition of a freely moving mass is shown to be physically meaningful to terms of second order. The calculation has close similarities to that for the analogous motion of a freely moving charge in electrodynamics, reinforcing the idea that a restricted set of coordinate transformations in general relativity corresponds to the gauge transformations of electrodynamics in special relativity. (auth)

13095 EQUATION OF GEODESIC DEVIATION IN NEWTONIAN THEORY AND THE OBLATENESS OF THE EARTH. Greenberg, P. J. (Univ. of Alberta, Edmonton). Nuovo Cim., 24B: No. 2, 272-286(11 Dec 1974).

Periodic solutions are found to the equation of geodesic deviation for a circular orbit in the equatorial plane of the earth. The oblateness of the earth is taken into account, and results are compared to the corresponding predictions of general relativity. (auth)

13096 REPRESENTATION OF THE GRAVITATIONAL AND ELECTROMAGNETIC FIELDS BY A TENSOR OF MIXED SYMMETRY. Smith, P. D. P. (Memorial Univ. of Newfoundland, St. John's). Nuovo Cim., 24B: No. 2, 255-271(11 Dec 1974).

The gravitational and electromagnetic interactions of a charged spinless test body and a massive charged source can be jointly described by a set of complex tetrad fields or the mixed-tensor field arising from them. The symmetric part of this mixed tensor must obey Einstein's field equations, provided that the conserved current density of these tetrad fields is proportional to the Lorentz four-potential. The four-potential can be expressed in various ways in terms of the antisymmetric part of the mixed tensor, and the Klein–Gordon equation describing the test body's motion in these combined fields can be expressed entirely in terms of the mixed tensor. (auth)

13097 CYLINDRICALLY SYMMETRIC BRANS–DICKE FIELDS. I. Rao, J.R.; Tiwari, R.N.; Bhamra, K.S. (Department of Mathematics, Indian Institute of Technology, Kharagpur, 721302 (S. E. Rly.), West Bengal, India). Ann. Phys. (N.Y.) 87: No. 2, 470-479 (Oct 1974).

A class of rigorous solutions for the Brans–Dicke scalar–tensor theory for Einstein–Rosen nonstatic cylindrically symmetric metric is obtained when only scalar field is present (vacuum solutions of Brans–Dicke theory). As the solutions of Brans–Dicke vacuum fields are conformal to either zero–mass scalar field or vacuum solutions of Einstein's gravitational theory, a set of solutions conformal to the above which correspond to zero–mass scalar field has also been obtained. (auth)

13098 CYLINDRICALLY SYMMETRIC BRANS–DICKE FIELDS. II. Rao, J.R.; Tiwari, R.N.; Bhamra, K.S. (Department of Mathematics, Indian Institute of Technology, Kharagpur, 721302, India). Ann. Phys. (N.Y.) 87: No. 2, 480-497 (Oct 1974).

The nonstatic cylindrically symmetric metric of Einstein–Rosen is considered, and a class of rigorous solutions for the Brans–Dicke scalar–tensor theory in the presence of source–free electromagnetic field is obtained. Since the Brans–Dicke scalar fields coupled with source–free electromagnetic fields are conformal to zero–mass fields combined with source–free electromagnetic fields of Einstein's gravitational theory, the solutions of the present work have been subjected to conformal transformation. These have been found to be the solutions of the coupled zero–mass and electromagnetic cylindrically symmetric fields described by Marder's metric. (auth)

13099 SINGULARITIES FOR FLUIDS WITH $p=\omega$ EQUATION OF STATE. Letelier, P. (Instituto de Física, Universidad Católica de Chile, Santiago, Chile); Tabensky, R. J. Math. Phys. (N.Y.) 16: No. 1, 8-10 (Jan 1975).

The structure of singularities is discussed for some exact solutions of Einstein equations for irrotational perfect fluids with equation of state pressure equal to energy density, $p=\omega$. It is found that all singularities studied are velocity–dominated of the semi–Kasner class. It is also found that data on the singularity are not enough to generate space–time for all times. (auth)

13100 GRAVITATIONAL AND ELECTROMAGNETIC RADIATION IN KERR–MAXWELL SPACES. Lind, R.W. (Department of Physics, Florida State University, Tallahassee, Florida 32306). J. Math. Phys. (N.Y.) 16: No. 1, 34-38 (Jan 1975).

The class of Kerr–Maxwell spaces is defined. This class consists of regular electrovac spacetimes in which a geodesic, diverging, shear–free principal null vector field of the Weyl tensor coincides with a principal null vector field of the Maxwell tensor. It is shown that this class admits no Petrov–Penrose type III or type N solutions. It is also shown that the most general nonradiative solution is the Kerr–Newman metric. (auth)

13101 STATIONARY KERR–MAXWELL SPACES. Lind, R.W. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). J. Math. Phys. (N.Y.) 16: No. 1, 39-43 (Jan 1975).

We consider algebraically special electrovac spacetimes in which a diverging, geodesic, shear–free (but twisting) degenerate principal null direction of the Weyl tensor coincides with a principal null direction of the Maxwell tensor. All stationary solutions of this class are solved exactly and found to be of Petrov–Penrose type D, the most general regular stationary solution being the Kerr–Newmann metric. (auth)

13102 AN EXACT DETERMINATION OF THE GRAVITATIONAL POTENTIALS g_{ij} IN TERMS OF THE GRAVITATIONAL FIELDS $R^i{}_{jkl}$. Ihrig, E. (Department of Mathematics, University of Toronto, Toronto, Ontario, Canada). J. Math. Phys. (N.Y.) 16: No. 1, 54-55 (Jan 1975).

Under a certain asymmetry assumption, the gravitational potentials g_{ij} are determined up to a conformal factor from the field $R^i{}_{jkl}$. This constitutes a partial solution to Einstein's equations in the general case. Moreover, the solutions are simple in that the g_{ij} are expressed as polynomial functions of the $R^i{}_{jkl}$. (auth)

13103 MOTION OF A BODY IN GENERAL RELATIVITY. Geroch, R.; Jang, P.S. (Department of Physics, University of Chicago, Chicago, Illinois). J. Math. Phys. (N.Y.) 16: No. 1, 65-67 (Jan 1975).

A simple theorem, whose physical interpretation is that an isolated, gravitating body in general relativity moves approximately along a geodesic, is obtained. (auth)

13104 SOME SOLUTIONS OF THE EINSTEIN FIELD EQUATIONS FOR A ROTATING PERFECT FLUID. Krasiński, A. (Institute of Theoretical Physics, Warsaw University, Warsaw, Poland). J. Math. Phys. (N.Y.) 16: No. 1, 125-131 (Jan 1975).

The equations of isentropic rotational motion of a perfect fluid are investigated with use of Darboux' theorem. It is shown that, together with the equation of continuity, they guarantee the existence of four scalar functions on space–time, which constitute a dynamically distinguished set of coordinates. It is assumed that in this coordinate system the metric tensor is constant along the lines tangent to velocity and vorticity fields. Under these assumptions a complete set of solutions of the field equations with $T_{ij} = (\epsilon + p)u_iu_j - pg_{ij}$ is found. They divide into three families, first of which contains six types of new solutions with nonzero pressure. The second family contains only the Gödel's solution, and the third one, only the Lanczos' solution. Symmetry groups, exterior metrics, type of conformal curvature, geometrical and physical properties of the new solutions are investigated. A short review of other models of rotating matter is given. (auth)

13105 STRUCTURAL EQUATIONS FOR KILLING TENSORS OF ORDER TWO. I. Hauser, I.; Malhiot, R.J. (Department of Physics, Illinois Institute of Technology, Chicago, Illinois 60616). J. Math. Phys. (N.Y.) 16: No. 1, 150-152 (Jan 1975).

For any Killing tensor $K_{\alpha\beta}$ of order two, a system of linear homogeneous first–order differential equations of the form $(F_A)_{,\alpha} = \Sigma_B (\Gamma_{\alpha AB} F_B)$ is derived. F_1, F_2, ... are the components of the tensors $K_{\alpha\beta}$, $L_{\alpha\beta\gamma} = 2K_{\gamma(\beta;\alpha)}$, and $M_{\alpha\beta\gamma\delta} = (1/2)(L_{\alpha\beta[\gamma;\delta]} + L_{\gamma\delta[\alpha;\beta]})$. The coefficients $\Gamma_{\alpha AB}$ are linear expressions in the Riemann tensor and its covariant derivative. These equations are analogous to those satisfied by a Killing vector K_α and the Killing bivector $\omega_{\alpha\beta} = K_{\beta;\alpha}$, with $L_{\alpha\beta\gamma}$ and $M_{\alpha\beta\gamma\delta}$ playing roles analogous to $\omega_{\alpha\beta}$. The tensor $L_{\alpha\beta\gamma}$ has the symmetries $L_{\alpha\beta\gamma} = -L_{\beta\alpha\gamma}$ and $L_{(\alpha\beta\gamma)} = 0$, and $M_{\alpha\beta\gamma\delta}$ has the symmetries of the Riemann tensor. Several relations similar to those satisfied by covariant derivatives of Killing vectors are derived. Perspectives for further work are briefly discussed with the idea of using the equations to investigate space–times which admit Killing tensors of order two. (auth)

13106 THE REST FRAME IN STATIONARY SPACE–TIMES WITH AXIAL SYMMETRY. Greene, R.D.; Schucking, E.L. (Department of Physics, New York University, New York, New York 10003); Vishveshwara, C.V. J. Math. Phys. (N.Y.) 16: No. 1, 153-157 (Jan 1975).

A rest frame in a stationary, axially symmetric space–time is defined as a synchronizable frame which is as nearly Killing as possible. This is a possible generalization of the Newtonian rest frame. A kinematical theorem giving the condition for the existence of a rest frame whose time vector is a linear combination of the Killing vectors is proved. The frame is also unique. The condition is shown to be weaker than the assumption of orthogonal transitivity. The surfaces of simultaneity of the rest frame are the surfaces of constancy of a particular Killing time coordinate, and its time vector is the component of the time Killing vector orthogonal to the angular Killing vector. Some properties of the rest frame are then discussed; it is shown that the frame is well–behaved down to the event horizon, where its time vector becomes null. Under a suitable condition on the event horizon, the time vector coincides with a Killing vector there. The gravitational redshift relation in the rest frame is derived. There is a dependence on the angular momentum of the geodesic. Furthermore, the event horizon is shown to be an infinite redshift surface for the rest frame observers. Finally, the three–vector potential of Landau and Lifshitz is interpreted and shown to be closely related to the rest frame, and a corresponding four–vector potential is invariantly defined. (auth)

13107 NEUTRINOS IN CYLINDRICALLY–SYMMETRIC SPACETIMES. Davis, T.M.; Ray, J.R. (Department of Physics and Astronomy, Clemson University, Clemson, South Carolina 29631). J. Math. Phys. (N.Y.) 16: No. 1, 80-81 (Jan 1975).

An exact solution to the Einstein–Dirac equations is presented for a static, cylindrically–symmetric spacetime. The neutrino field is nonzero and corresponds to a neutrino current in the radial direction. The neutrinos yield a zero energy–momentum tensor and, therefore, the gravitational field is the same as for the vacuum case. The neutrinos in these static, cylindrically–symmetric spacetimes can exist only if the spacetimes are locally equivalent to static plane–symmetric spacetimes This type of "ghost neutrino" solution is already known to exist in plane–symmetric spacetimes. (auth)

13108 GHOST NEUTRINOS IN PLANE–SYMMETRIC SPACETIMES. Davis, T.M.; Ray, J.R. (Department of Physics and Astronomy, Clemson University, Clemson, South Carolina 29631). J. Math. Phys. (N.Y.) 16: No. 1, 75-79 (Jan 1975).

An exact solution to the Einstein–Dirac equations is presented for a plane–symmetric spacetime generated by neutrinos. The neutrino field is nonzero and corresponds to a neutrino current along the symmetry axis of the space. The neutrinos yield a nonzero energy–momentum tensor, which we specialize to $T_{ij} = 0$ for "ghost" neutrinos. We show that, since the energy–momentum tensor vanishes, the time–dependent "ghost" neutrino metric reduces to the static case. The time–dependent "ghost" current is then reduced to the static current through a Lorentz transformation and the "ghost" wavefunction reduced to the static wavefunction through a spinor transformation. The "ghost" neutrino current is geodesic and the spacetime is classified by the expansion, rotation, and shear of these geodesics. From previous results it follows that our plane–symmetric "ghost" solution is the most general solution to the Einstein–Dirac equations for a vanishing energy–momentum tensor and a neutrino current that is expanding. The solution is Petrov type D. (auth)

13109 TACHYON BEHAVIOR IN GENERAL RELATIVITY. Sigal, R.; Shamaly, A. (Theoretical Physics Institute, The University of Alberta, Edmonton, Alberta, Canada). Phys. Rev. D 10: No. 8, 2358-2361 (15 Oct 1974).

It is shown that cosmological structures can be used to make tachyonic theories that do not contain logical paradoxes. A general–relativistic Proca equation is then analyzed as an example of a field–theoretic model that can have this type of tachyonic behavior. It is found that only one form of this equation never gives tachyon–type behavior. (auth)

13110 GRAVITATIONAL ENERGY. Murchadha, N.O.; York, J.W. Jr. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540 and Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27514). Phys. Rev. D 10: No. 8, 2345-2357 (15 Oct 1974).

The total energy of asymptotically flat, nonsingular gravitational fields is discussed in terms of the initial data on a spacelike hypersurface. The total energy is a surface integral which we relate to a volume integral over "sources," including the contributions of gravitational waves. This relationship follows from a recent formulation of the initial–value equations of general relativity and is free of coordinate conditions. We show that time–symmetric initial–data sets form minima of energy among all initial–data sets on maximal hypersurfaces. Combining this result with a result of Brill, it follows that every nonsingular, axisymmetric, asymptotically flat spacetime admitting at least one maximal slice has non–negative total energy. Negative "interaction energy" contributions are described and a discussion of nonmaximal initial data is given. (auth)

13111 GRAVITATIONAL RED–SHIFT MEASUREMENTS AS TESTS OF NONMETRIC THEORIES OF GRAVITY. Will, C.M. (Laboratory for Astrophysics and Space Research, University of Chicago, Chicago, Illinois 60637). Phys. Rev. D 10: No. 8, 2330-2337 (15 Oct 1974).

Gravitational red–shift measurements can be powerful tools for testing nonmetric theories of gravity. We show that some nonmetric gravitation theories may predict the "wrong" first–order gravitational red shift even while possessing the "correct" Newtonian limit, whereas metric theories with the "correct" Newtonian limit automatically predict the "correct" red shift. We also argue that all nonmetric theories ultimately predict a red shift which depends on the nature of the atomic clock whose red shift is being measured. These statements can be worded in the form of a conjecture: Any complete, self–consistent, and relativistic theory of gravity that embodies the universality of gravitational red shift is necessarily a metric theory. Restricting attention to a certain subclass of nonmetric theories and to electromagnetic atomic clocks residing in static, spherically symmetric gravitational fields, we give a detailed proof of this conjecture. Red–shift experiments can thus distinguish between metric and nonmetric theories of gravity. For weak gravitational fields appropriate to the solar system, we compare the sensitivity of red–shift experiments and Eötvös experiments to nonmetric effects. Particularly important are null red–shift measurements (comparison of the red shifts of different clocks at the same location in gravitational field) designed to be sensitive to second–order gravitational red shifts. (auth)

13112 GENERALIZED WILKINS EFFECT AND SELECTED ORBITS IN A KERR–NEWMAN GEOMETRY. Johnston, M.; Ruffini, R. (Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. D 10: No. 8, 2324-2329 (15 Oct 1974).

Wilkins has pointed out that, in addition to the periodicities associated with circular orbits in the equatorial plane of a Kerr geometry, there exist periodicities connected with the longitudinal motion of particles. We extend this result to spherical orbits of charged particles in a Kerr–Newman geometry. We give explicit examples of nonspherical orbits, illustrating dragging of inertial frames and these longitudinal periodicities. The relevance of these results for the physics of collapsed objects is discussed. (auth)

13113 SOLUTION OF THE EINSTEIN–MAXWELL EQUATIONS FOR TWO UNEQUAL SPINNING SOURCES IN EQUILIBRIUM. Kobiske, R.A. (Department of Physics, Milwaukee School of Engineering, 1025 N. Milwaukee Street, Milwaukee, Wisconsin 53201); Parker, L. Phys. Rev. D 10: No. 8, 2321-2324 (15 Oct 1974).

Starting with the basic equations developed by Israel and Wilson, and Perjes, we give the explicit form for the axially symmetric metric corresponding to two charged spinning Kerr–Newman sources in equilibrium under their mutual electromagnetic and gravitational forces. Spin directions can be parallel or antiparallel along the symmetry axis, and arbitrary spin magnitudes and complex charge parameters are

assumed throughout. We show that the condition for proper asymptotic behavior of the metric requires that the magnetic monopole moment of the charge distribution vanish (to within a duality transformation), possibly implying a deep connection between the asymptotic properties of the gravitational field and the absence of free magnetic monopoles. The requirement of regularity of the metric along the z axis between the sources fixes the value of the imaginary (magnetic) part of the complex charge parameters. (auth)

13114 CONSERVATION LAWS, GRAVITATIONAL WAVES, AND MASS LOSSES IN THE DICKE–BRANS–JORDAN THEORY OF GRAVITY. Lee, D.L. (California Institute of Technology, Pasadena, California 91109). Phys. Rev. D 10: No. 8, 2374-2383 (15 Oct 1974).

In the Dicke–Brans–Jordan theory of gravity, far away from a bounded system, orbiting test particles measure the total, active gravitational mass M while orbiting test black holes measure the "tensor" mass M_T. Their difference $(M-M_T)$ is the scalar mass M_S. In this paper, conservation laws for M_S, M_T and M are delineated and are used to show the following: (i) A spin–2 gravitational plane wave carries tensor mass, but does not carry scalar mass; the flux of tensor mass is proportional to the square of the time–integrated amplitude of the Riemann tensor $|\int\Psi_4 dt|^2$. (ii) A spin–0 gravitational plane wave carries both tensor mass (flux proportional to the square of the time–integrated Riemann amplitude $|\int\Phi_{22}dt|^2$) and scalar mass (flux proportional to the Riemann amplitude Φ_{22}—or, equivalently, proportional to the second time derivatives of the amplitude of the scalar field $\partial^2\phi/\partial t^2$). (iii) The tensor mass in a gravitational wave curves up the background spacetime through which the wave propagates; the scalar mass does not. (iv) The tensor mass in a wave is positive–definite; the scalar mass is not. (v) If a dynamical spherical system emits gravitational waves that change its scalar mass by ΔM_S in time τ (ΔM_S may be positive or negative), then these waves will also reduce its tensor mass by an amount $\geq (\Delta M_S)^2/\tau$. The response of gravitational–wave antennas to scalar waves is discussed. It is shown that, whereas antennas of negligible self–gravity respond only to the tidal forces of the wave (Φ_{22}), antennas with significant self–gravity respond about equally to the tidal forces Φ_{22} and the oscillating Cavendish gravitation constant ϕ. Because of the unique phase and amplitude relations of Φ_{22} and ϕ, the two responses are coherent—and can even cancel each other perfectly for a "carefully designed" detector. (auth)

13115 GAUGE–FREE QUANTIZATION OF THE LINEARIZED EQUATIONS OF GENERAL RELATIVITY. Malin, S. (Department of Physics and Astronomy, Colgate University, Hamilton, New York 13346). Phys. Rev. D 10: No. 8, 2338-2345 (15 Oct 1974).

Carmeli's method of gauge–free quantization of the electromagnetic field is extended to the case of the linearized equations of general relativity. The first–order Newman–Penrose equations with a particular choice of frames of reference and tetrad system are formulated in terms of functions over the group SU_2 and all the field variables are expressed in terms of one complex function. The equation for this function is derived and a canonical gauge–free quantization procedure is carried out. Implications of these results to the problem of quantization of the exact (nonlinear) equations of general relativity are discussed. (auth)

13116 RELATIVITY AND QUANTIZING: GRAVITATIONAL ENERGY. Anastasov, A. Kh. (Sofia Univ. (Bulgaria). Katedra po Atomna Fizika). Compt. Rend. Acad. Bulg. Sci.; 26: No. 5, 603(1973). (In French).

A discreet relativistic model of the particle concept is used. It is called for brevity the minipulsar. All observable quantities are defined in the usual manner in the theory of relativity but on the basis of the eigenfrequency and eigenvector concepts of the minipulsar. It follows that all the observable quantities can not be measured exactly. A centrometric nonstatic pulsating metric and a new metric are considered. It is assumed that the Schwarzschild solution is an approximate description of the case of a center. The components of the Einstein tensor are obtained. In the new centrometric metric the matter tensor is defined. (tr-auth)

13117 SOLUTIONS OF THE KERR–NEWMAN–UNTI–TAMBURINO TYPE FOR THE EINSTEIN EQUATIONS WITH THE COSMOLOGICAL TERM. Frolov, V. P. (Lebedev Inst. of Physics, Moscow). Teor. Mat. Fiz.; 21: No. 2, 213-223 (Nov 1974). (In Russian).

On the basis of the Newman–Penrose formalism new solutions of the Einstein equations with the cosmological term are obtained, which generalize the known solutions by Kerr and Newman–Unti–Tamburino. (auth)

13118 SOLAR OBLATENESS, EXCESS BRIGHTNESS, AND RELATIVITY. Hill, H.A.; Clayton, P.D.; Patz, D.L.; Healy, A.W. (Department of Physics, University of Arizona, Tucson, Arizona 85721); Stebbins, R.T.; Oleson, J.R.; Zanoni, C.A. Phys. Rev. Lett. 33: No. 25, 1497-1500 (16 Dec 1974).

New observations show a small difference between the sun's polar and equatorial limb darkening functions. This excess equatorial brightness varies in time and can be of sufficient magnitude to account for the solar oblateness inferred by Dicke and Goldenberg from their measurements. This removes the serious consequence of their work for Einstein's general theory of relativity. The problems of a solar–edge definition and the derivation of a solar mass quadrupole moment are discussed. (auth)

13119 YANG'S GRAVITATIONAL FIELD EQUATIONS. Pavelle, R. (Perception Technology Corporation, Winchester, Massachusetts 01890). Phys. Rev. Lett. 33: No. 24, 1461-1463 (9 Dec 1974).

The gravitational field equations proposed by Yang are shown to be identical with those proposed by Kilmister in 1959. The static, spherically symmetric solution of the Kilmister–Yang field equations is found. It is shown that solar experiments cannot yet distinguish between these equations and Einstein's vacuum equations. (auth)

REACTOR TECHNOLOGY AND REGULATION

13120 (INIS-mf-1413) SHALL WE STAKE ON ATOMIC POWER. Reproduction of a Series of Informative Articles from Ingenioerens Ugeblad, 1973–1974. 1974. 70p. (In Danish). INIS.

A collection of 34 articles by 21 authors dealing with problems relating to the introduction of nuclear power stations in Denmark. Main emphasis is laid on information and reference material. (INIS)

13121 AUTOMATION OF THE CONTROL OF TURBINE STARTING AT NUCLEAR POWER STATIONS. Leizerovick, A. Sh.; Malamed, A. D. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 32-37(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 24-29(1974).

Principles for automatic control of steam turbine startup at power reactors are discussed. (JWR)

13122 ASME CODE REQUIREMENTS FOR INSERVICE INSPECTION OF NUCLEAR PLANTS. Nucl. Eng. Int.; 19: No. 222, 925-930(Nov 1974).

The 1974 edition of Section XI of the ASME code "Rules for in-service inspection of nuclear power plant components" has extensively augmented its scope of application. The new format and the main changes are discussed. These include rules for in-service testing of Class 1 pumps and valves; expansion to cover components in Classes 2 and 3; extensively revised ultrasonic examination procedures; new standards for examination evaluation; revised approach to evaluation of flaw indications; and new requirements for repair procedures. Acceptance levels are summarized and reference is made to some future developments. (UK)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 13330, 13331, 13334, and 13338.

13123 (CONF-741065–24) STOCHASTIC STUDY OF NOISE IN BOILING REACTORS. Matthey, M. (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).

A stochastic point model of a boiling reactor, involving the population of neutrons, the population of delayed neutron precursors, the fuel temperature and the number of bubbles in coolant as random variables, is considered. Whereas the first two variables are related to capture, fission and delayed neutron processes, the other two take into account heat transfer between fuel and coolant and changes in coolant density. Variations in the fuel temperature and coolant density generate reactivity feedbacks which affect the neutron power spectral density. Analysis of the shape of this spectral density is expected to give information on the value of reactor parameters such as, for example, the void coefficient. Comparison with experiments is being done in a first step using electrically heated elements to produce local boiling in the core of the UO_2-H_2O reactor CROCUS. (auth)

13124 (JUL-Conf-10) PROCEEDINGS OF THE SECOND INDO-GERMAN SEMINAR HELD AT JUELICH, 18–20 SEPTEMBER 1972. Part I. Optimal Recycling of Pu in Heavy Water and Light Water Reactors. Part II. Irradiation Facilities. Scharmer, K.; Schober, J. (comps.). (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). Dec 1973. 497p. (CONF-7209121-).

From 2nd Indo-German seminar; Julich, F. R. Germany (18 Sep 1972).

Part I contains twelve papers dealing with economic and technical aspects of utilizing plutonium in light water and heavy water reactors. The nine papers in Part II deal with irradiation facilities and techniques useful in fuel element development and testing of reactor structural materials. Eighteen papers have been separately abstracted and indexed. Three papers were previously abstracted, appearing as abstract numbers 29: 14622, 29: 23622, and 28: 01744. (DG)

For abstracts of individual papers see: 10841, 10842, 13125, 13126, 13146, 13167, 13178, 13190, 13191, 13265–13268, 13342–13344, 13418, and 13419.

13125 (JUL-Conf-10, pp 102-129) SUPPLY OF PLUTONIUM FUEL ELEMENTS IN THE FRAME OF RELOADS FOR BOILING WATER REACTORS. Kilian, P.; Pohl, P.; Spierling, H. (AEG-Telefunken, Frankfurt am Main). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

The amounts of plutonium available to utilities for recycle in thermal reactors will increase rapidly in the near future. In the past several years the technological feasibility of recycling plutonium in BWR's has already been proven in various development programs in Germany and elsewhere. AEG-Telefunken has recognized the increasing significance of this subject for many years. Theoretical and experimental work related to the utilization of plutonium in BWR's was begun in 1965 and has been a considerable effort over the years. Some aspects of the approach taken by AEG-Telefunken in the design and supply of plutonium recycle fuel as reload for a Boiling Water Reactor are described. (auth)

13126 (JUL-Conf-10, pp 365-402) IRRADIATION TESTING AND IN-PILE-MEASUREMENTS ON FUEL RODS FOR WATER-COOLED POWER REACTORS. Grziwa, P.; Krawczynski, S. (Kernforschungsanlage, Juelich, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Fuel pin design parameters are discussed, and the role of in-pile experiments in providing data useful in fuel design is examined. Fuel irradiation tests conducted at FRJ-2, HBWR, and HFR are described, and irradiation data and test results are presented. (DG)

13127 (LIB/Trans-540) EFFECT OF SOME DESIGN AND OPERATING PARAMETERS ON THE ORIGIN OF DEFECTS IN THE FUEL RODS OF BOILING WATER REACTORS. Grziwa, P.; Kuhn, H. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany); Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Grossauheim (F.R. Germany)). Aug 1974. Translation by A. Bicervskis of Paper 5/8. (CONF-721062–4). 10p. Dep. NTIS (US Sales Only) $4.00.

From NUCLEX 1972: 3rd international fair of nuclear industries and technical meetings; Basel, Switzerland (16 Oct 1972).

Typical BWR fuel rod defects are discussed and classified according to the failure characteristics. The origin of the defects is investigated in terms of some design and operating parameters. Some recommendations are made to reduce the failure rate. (auth)

13128 TEMPERATURE DISTRIBUTION OF REACTOR PRESSURE VESSEL. Hayashi, T.; Hamada, K.; Ukaji, H.; Oyamada, O. (Hitachi Ltd., Ibaraki, Japan). Atsuryoku Gijutsu; 11: No. 2, 112-117(Mar 1973). (In Japanese).

The calculation method is presented for temperature distribution at both main flange and supporting skirt which are the most critical parts in the design of reactor pressure vessels. Calculated values are compared with measured values in the reactor pressure vessel of a commercial boiling water reactor. (JA)

13129 CONSTRUCTION OF HAMAOKA ATOMIC POWER STATION. Yasui, T. (Chubu Electric Power Co. Inc., Nagoya, Japan). Karyoku Hatsuden; 24: No. 1, 18-28(Jan 1973). (In Japanese).

The outline and the construction status of Hamaoka power station, a 540 MW(e) BWR plant, are described. Site arrangement, layout of the whole plant, and the outline of each component system are explained. The outline of gas, liquid and solid waste disposal systems is described, and a flow diagram of radioactive waste disposal system is given. The rare gas hold-up system with active charcoal is one of the main features of this plant. The imported components and the components made in Japan are shown. Some features of plant design are described. The progress of construction is shown. (JA)

13130 PROBLEMS RELATED TO CONCRETE CONSTRUCTION FOR NUCLEAR POWER STATIONS. Toki, T. (Takenaka Komuten Co. Ltd., Tokyo). Konkurito Janaru; 12: No. 6, 24-30 (Jun 1974). (In Japanese).

In the nuclear power plants with light-water reactors under construction in Japan, housing structures are mostly made of reinforced concrete. While essentially it is not different from ordinary concrete, the requirements stemming from the characteristics of nuclear power plants are stringent. The structures are generally complicated with many penetrations, and their height is very high, in addition, radiation shielding is necessary.

And its construction is intimately associated with other works. The following are described: the features of concrete housings; the process of concrete-structure construction; concrete works in general, including materials, mixing, placing and curing, forms, and summer and winter concrete placing; special concrete including mass concrete and shielding concrete, and concrete-filling beneath containment vessels. (JA)

13131 PRESENT CONDITION AND PROBLEMS ON DESIGN METHODS OF CONCRETE STRUCTURES FOR NUCLEAR POWER STATIONS. Akino, K.; Tamura, S.; Watanabe, Y. (Japan Atomic Power Co., Tokyo). Konkurito Janaru; 12: No. 6, 14-23(Jun 1974). (In Japanese).

Nearly all nuclear power plants either in operation or under construction in Japan use light-water reactors. For this type of power stations, the design technology of their concrete structures has been nearly completed in Japan. The present status of the design and the problems revealed in the design of the concrete structures for BWRs in particular are described. The concrete structures for light-water nuclear power stations can be grouped in reactor housing, turbine building, water intake, etc. The design phases cover the following items: design standards, aseismatic design, load condition, method of analysis, component design and allowable stress. (JA)

13132 INSERVICE INSPECTION OF NUCLEAR POWER STATION. Miyoshi, S. (Fuji Electric Co. Ltd., Tokyo). Atsuryoku Gijutsu; 10: No. 6, 50-57(Nov 1972). (In Japanese).

However high the standard in the manufacture of the components for a nuclear power plant is, there is need for inspection during its operation. This inspection is inservice inspection of a nuclear power station. For this purpose there is ASME B & P Code Sec. XI; which is utilized in all countries. The objects of the inservice inspection are thus the components constituting cooling-water pressure boundaries of PWRs and BWRs, including reactor-plant cooling systems, and also auxiliary and emergency cooling systems. The background giving rise to the establishment of the ASME code and its contents are described, and also contents of the IAEA's manual for the regular inspection of nuclear reactor steel pressure vessels are given. Finally, problems in the nondestructive tests for the inservice inspection are indicated, including liquid penetration, magnetic-substance powder, replica, radiation penetration and ultrasonic tests. (JA)

13133 SCHEDULE-AND-PROCESS MANAGEMENT IN CONSTRUCTION OF A NUCLEAR POWER PLANT. Aoyama, T. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Japan). Haikan Gijutsu; 16: No. 4, 120-128(Apr 1974). (In Japanese).

Nuclear power plants either in operation or under construction in Japan use mostly light-water reactors. Among this type of nuclear power plants, the construction works in a BWR power station in particular are described, concerning the installation of machinery and electric facilities: features of the nuclear power station, outline of the construction works of the nuclear power station, and process management in the construction of the nuclear power station. The whole process from site preparation, through the installation of facilities, to plant test operation is scheduled. Characteristic features of the construction are extended construction period, numerous pipings and wirings, stringent requirement of quality control, etc. (JA)

13134 CONSTRUCTION OF FUKUSHIMA NUCLEAR POWER STATION UNIT NO. 3. Nomura, A.; Tanaka, H.; Shirasaka, Y. (Tokyo Electric Power Co. Inc.). Konkurito Janaru; 12: No. 6, 72-81(Jun 1974). (In Japanese).

Construction works of buildings are nearly complete for the Unit No. 3 of the Fukushima Nuclear Power Station. It employs a BWR with the electric output of 784 MW, built wholly by domestic technology. The construction works of main buildings, i.e., those for reactor, turbine, control, etc., are described as follows: outline of building structures; earthwork, concrete Caggregate, cement, etc.), reinforcement, form works, and filling beneath a dry well; and standardization and prefabrication of building concrete-members for future construction. (JA)

13135 HYDRODYNAMICS OF ADIABATIC TWO-PHASE FLOW IN LARGE CORE RISERS. Dubrovskii, I. S. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 41-45(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 31-35(1974).

An experimental investigation of the hydrodynamics of adiabatic two-phase flow in core risers of BWR type reactors was performed. The data on volumetric steam content and circulation show the utility of core risers in improving natural circulation. (JWR)

13136 INSPECTION OF LWR PRESSURE VESSELS TO ASME REQUIREMENTS. Watkins, B. (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucl. Eng. Int.; 19: No. 222, 938-941(Nov 1974).

Some of the methods used in BWR's and PWR's to facilitate in-service inspection, where access is restricted, are discussed. The procedures for inspecting the Borssele reactor by ultrasonic inspection and closed-circuit TV are described. Staffing requirements for inspection service are considered. The desirability of close liason between the inspection agency with the utility, the plant manufacturers, and also with the licensing authorities is discussed. (UK)

13137 INSERVICE INSPECTION OF NUCLEAR REACTORS IN THE FEDERAL REPUBLIC OF GERMANY. Schaeufl, A. (Maschinen fabrik Augsburg-Nuremberg (M. A. N.) A. G.). Nucl. Eng. Int.; 19: No. 222, 931-934(Nov 1974).

The requirements for inservice inspection of water reactors in the German Federal Republic, as laid down in guidelines published by the German Reactor Safety Commission (RSK) for both inspection technique and scope, are explained. The facilities, which are described, are of three main categories: probe systems, electronic equipment for control, recording, and evaluation, and also installations for manipulation of probe systems by remote control. The procedure for inspection is briefly outlined and an indication is given of how the equipment was applied to various inspection jobs using different types of manipulators on nuclear reactors in Germany and Switzerland. (UK)

13138 ULTRASONIC EXAMINATION OF LWR PLANTS USING AN AUTOMATED INSPECTION SYSTEM. Walter, J. H. (Atomic International Div., Canoga Park, CA). Nucl. Eng. Int.; 19: No. 222, 941-942(Nov 1974).

In order to meet the pre and in-service requirements of light water reactors, an automated ultrasonic system has been developed and is currently being used in the field for a variety of reactor inspections. This is described. The experience to date has demonstrated the practicality of utilizing the minicomputer based automated system under field conditions and the ability of the portable central control and data console to operate a variety of ultrasonic inspection tools covering the complex geometries requiring examination by Section XI of the ASME Boiler and Pressure Vessel Code. (auth)

13139 HYDRAULIC CHARACTERISTICS OF A VALVE IN TWO-PHASE FLOW. Tremblay, P. E.; Andrews, D. G. (Univ. of Toronto). Can. J. Chem. Eng.; 52: No. 4, 433-437(Aug 1974).

In the case of boiling in nuclear reactor channels, it is apparent that the hydraulic characteristics of any valves used to control channel flowrates may have an important bearing on the critical channel power for the initiation of oscillations. The present investigation was therefore undertaken to determine the best model for two-phase water-steam pressure drop across such a valve. Pressures were between 300 and 1000 psig, mass fluxes between 0.1 and 0.5×10^6 lb m/hr-ft^2 and qualities up to 64%. The measurements were made in the FLARE rig of Atomic Energy of Canada Ltd. by one author during the course of a doctoral study on boiling instabilities. Various pressure-drop models were tried. It was found that for turbulent flow a homogeneous model was the best. (auth)

13140 NUCLEAR REACTOR UTILIZING PLUTONIUM IN PERIPHERAL FUEL ASSEMBLIES. Crowther, R. L. (to General Electric Co.). US Patent 3,844,886. 29 Oct 1974. Filed Date 16 Apr 1971. 12p.

A nuclear reactor core for effectively utilizing plutonium fuel is described. The plutonium fuel is placed in the fuel assemblies at the periphery of the core, in the low energy neutron spectrum region, to take advantage of the characteristics of the plutonium fuel and to optimize the use of the peripheral portion of the core. (Official Gazette)

13141 FAILURE INDICATOR FOR NUCLEAR REACTOR FUEL ELEMENT. Jones, C. R.; Goldman, A. J.; Rowe, D. G. (to Transfer Systems Inc.). US Patent 3,846,235. 5 Nov 1974. Filed Date 3 Nov 1972. 10p.

An improved failure indicator for a nuclear reactor fuel element is described. The failure indicator features a movable indicator pin maintained under constant spring pressure toward a failure position but maintained in a safe position by internal fuel pressurization or a corrodible member. The indicator pin is totally enclosed and isolated from the coolant environment. A magnetic member is connected to the indicator pin and its position is magnetically sensed to determine failed fuel. A feature of the construction is the avoidance of pressure-tight structural seals between dissimilar materials. (Official Gazette)

13142 OPERATING AND MAINTENANCE EXPERIENCE OF TARAPUR ATOMIC POWER STATION. Dayal, M. (Tarapur Atomic Power Station, India). pp 217-234 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

Power production and availability data are presented, and refueling and inspection activities are described together with reactor maintenance and component failures. (DG)

13143 AUXILIARY PUMPS FOR THE PRIMARY CIRCUIT OF THE 800 MW NUCLEAR POWER STATION CAORSO EIV OF ENEL, ITALY. Laux, C. H. (Sulzer Bros., Ltd., Leeds, Eng.). Sulzer Tech. Rev.; 56: No. 1, 19-28(1974).

The auxiliary pumps for the safety system of a boiling-water reactor are feed pumps of a special type. The importance and duties of auxiliary pumps in this system are described together with their design features. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 13124, 13126, 13130–13132, 13136–13138, 13141, 13316, 13317, 13327, 13330, 13331, 13334, 13383, 13394–13396, and 13400.

13144 (BNWL-CC-1495) DIGITAL PROGRAM FOR THE PREDICTION AND ANALYSIS OF ONE-DIMENSIONAL, TWO-PHASE FLOW TRANSIENTS FOLLOWING SUDDEN LOSS OF COOLANT OR LOSS OF PRESSURE. Rowe, D. S.; Garlid, K. L.; Moulton, R. W.; England, D. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1967. 45p. Dep. NTIS $5.25.

Loss of coolant supply or loss of pressure in a pressurized water nuclear reactor can cause severe damage to the reactor or constitute a dangerous hazard. Therefore, it is necessary to employ operating limits and procedures to prevent or reduce the consequences of such incidents. To define these limits and procedures, an adequate description is required of the state of the coolant throughout the reactor following the incident. Of particular interest is the void (steam) formation which can have a strong influence on reactivity during the early phases of the accident transient. The computer program described was developed to aid in the description and analysis of this transient behavior of the coolant in a flow channel of a pressure-tube type reactor. It represents a preliminary effort in the mathematical description of such an event and necessarily contains several simplifying assumptions. For example, it is assumed that all flow is one-dimensional. Also, it is assumed that the cross-sectional area of the flow channel is constant. It is expected, however, that some of these assumptions may be relaxed in future work so that a more realistic and complex geometry may be described. (auth)

13145 (IAEA-R-994-F) INTEGRAL SAFEGUARDS EXPERIMENT AT THE NOVO-VORONEZH LWR POWER REACTOR PLANT. Skvortsov, S. A.; Miller, O. A.; Golubev, L. I. (International Atomic Energy Agency, Vienna (Austria)). Feb 1973. vp. (In Russian). INIS.

Safeguard works carried out at Novo-Voronezh Power Station, USSR, over the period 1 January 1971–31 December 1972 are reported. The station is of the water-moderated water-cooled type which has a high probability of export to Eastern Europe. The studies included an integral experiment covering all the requirements of the IAEA's questionnaire, accounting and reporting documentation and inspection procedures; a comparison of the methods available for measuring the reactor power; and investigation of gamma spectrometric determination of burnup in irradiated fuel assemblies. On the basis of this work the report raises several important points concerning the means of identification of fuel assemblies; the need for sealing in various areas; the adequacy of the Agency's questionnaire; the form and frequency of reports to be submitted to the Agency; and makes recommendations with regard to the inspection procedures and frequency of inspection required to safeguard this type of reactor. On the basis of the recommendations made it is suggested that a technical assessment as to whether or not nuclear material has been diverted can be made with an accuracy of 3-5% at the 95% probability level. (INIS)

13146 (JUL-Conf-10, pp 45-77) DESIGN OPTIMIZATION FOR RECYCLING PLUTONIUM IN H_2O-PRESSURIZED WATER REACTORS. Maerkl, H. (Siemens Aktiegesellschaft, Erlangen, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Plutonium production figures based on light water reactor operation in the Federal Republic of Germany are presented, and the fuel cycle economics of plutonium recycle in light water reactors is discussed. The fundamental differences between plutonium and uranium fuel are discussed, and problems resulting from plutonium properties are mentioned. Possible approaches to the economical recycle of plutonium in PWR type reactors are discussed together with the Obrigheim plutonium recycle demonstration program. (DG)

13147 (XN-209(Suppl. 4)) DENSIFICATION EFFECTS ON EXXON NUCLEAR PRESSURIZED WATER REACTOR FUEL. Supplement 4. (Exxon Nuclear Co., Richland, Wash. (USA)). 22 Nov 1974. 21p.

A description is given of modifications to the calculational procedures incorporated in the PWR densification model to account for a threshold in fuel pellet burnup below which irradiation-induced UO_2 swelling does not affect the pellet dimensions, and the potential for absorption of helium fill gas into the UO_2 fuel pellets. Analytical results are also provided which compare fuel and clad temperatures predicted using the computer codes GAPEX and JEREPP. The input data used in the calculations and a general description of the JEREPP code calculational technique are also provided. (auth)

13148 ROUTINE PWR PRESSURE VESSEL CHECKOUT. Saglio, R. (CEA, Paris). Nucl. Eng. Int.; 19: No. 222, 934-937(Nov 1974).

The inspection of PWR reactor vessels presents problems related to vessel construction and control automation. Control efficiency depends upon cladding condition and material, shape dissimilar metal weld grain size, and the type of transducers used. These influences are briefly discussed. A new unit, developed in France to effect control automation for minimizing checkout time and for increasing reliability for PWR vessel inspection, is described. Techniques are included for inspecting nozzles, safe ends and flange. Controls are both ultrasonic and visual, with a TV camera. The equipment complies with the ASME code and with French Regulations and will be used on the French PWR vessel. (UK)

13149 FEATURES OF THE DYNAMIC BEHAVIOR OF PRESSURIZED-WATER REACTOR NUCLEAR POWER PLANTS DURING BURNUP STRETCHOUT. Hampel, R. Kernenergie; 17: No. 10, 324-329(Oct 1974). (In German).

As to the control of nuclear power plants during burnup stretchout some features arise which are mainly based on the lack of built-in reactivity. The mathematical model for the long-term dynamic behaviour of nuclear power plants with pressurized-water reactor allows a study of the influence of operational regime on the stability of operation during burnup stretchout. The results obtained are discussed for the cases of the Rheinsberg and "Bruno Leuschner" Greifswald nuclear power plants. 5 references. (auth)

13150 DESIGN CRITERIA, CODES, AND STANDARDS FOR THE WESTINGHOUSE PWR. Wredberg, L. O. (Westinghouse Electric Nuclear Energy Systems, Brussels). J. Inst. Nucl. Eng.; 15: No. 4, 114-121(Jul 1974).

From 5th FORATOM congress; Florence, Italy (15 Oct 1973).

A description is given of the more important design and safety criteria, codes, and standards applied in the design of the Nuclear Steam Supply System of a Westinghouse Standard Design Pressurized Water Reactor (PWR). Both general design criteria and specific design criteria are reviewed for the reactor, including fuel, control system and internals. (auth)

13151 CONTROLLING THE OUTPUT OF TURBINE-DRIVEN FEEDPUMPS FOR A VVER-1000 REACTOR UNIT OF A NUCLEAR POWER STATION. Naumov, A. V.; Bobrov, I. P. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 14-22(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 10-17(1974).

A system for the control of the output of feedwater turbopumps in a two-loop WWER-1000 reactor is described. (JWR)

13152 METHOD OF FINDING THE SOURCES OF WIDE-BAND DISTURBANCE OF COOLANT PRESSURE FLUCTUATIONS IN THE COOLING LOOPS OF WATER-MODERATED WATER-COOLED POWER REACTORS. Samarin, A. A.; Nozdrin, G. N. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 28-31(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 21-24(1974).

The problem of hydrodynamic stability in the primary loop of water-cooled water-moderated reactors is discussed. Methods for determining the sources of disturbances are described. (JWR)

13153 INFLUENCE OF THE NONUNIFORMITY OF HEAT SUPPLY ON CRITICAL CAPACITY OF THE CHANNEL OF A BOILING REACTOR. Bergel'son, B. R.; Dostov, A. I.; Zorikoev, G. A. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 46-49 (Feb 1974).

Translated from teploenergetika; 21: No. 2, 35-38(1974).

The analytical dependence of the critical capacity of a BWR

coolant channel on the thermal and hydraulic characteristics of the flow and on the channel geometry is derived. (JWR)

13154 OPTIMIZING THE CAMPAIGN AND BURNUP STRETCHOUT TIMES IN PRESSURIZED-WATER REACTOR NUCLEAR POWER PLANTS. Ackermann, G.; Kertscher, F. Kernenergie; 17: No. 10, 313-319(Oct 1974). (In German).

A simple analytical expression is derived for describing the relationship between efficient full-load campaign, fraction of fresh fuel, initial enrichment, and burnup stretchout time in a periodical operational regime of pressurized-water reactors. This makes minimizing the specific cost of power generation with regard to some requirements on the part of mains and maintenance possible. Adjoint optimum values for the campaign and stretchout time are determined and various factors of influence are discussed. Besides reduction of the specific cost of power generation, burnup stretchout is shown to provide economically justifiable high flexibility in selecting campaign time and, consequently, in fitting the refueling cycles to the requirements made on the part of the mains and maintenance. The method proposed for optimization makes up a useful complement of the well-known techniques of burnup calculation and proves adequate for the long-term planning of optimum employment of nuclear power plants in a power system. 11 references. (auth)

13155 MODEL FOR STRATEGICALLY OPTIMIZING FUELLING OF A PRESSURIZED-WATER REACTOR NUCLEAR POWER PLANT. Luetzow, K. Kernenergie; 17: No. 10, 308-313(Oct 1974). (In German).

A model (DYÖP) is described which, by use of the method of "dynamical optimization," allows the determination of optimum strategies for fuelling a nuclear power plant unit with pressurized-water reactor. The requirements on the part of mains are taken into account in form of load factors and partial load characteristics to be given for each campaign of the reactor as well as by specific secondary constraints. Moreover, input data from models for reactor burnup calculation have been used. The results of preliminary computations within the scope of trend studies are given. Potential magnitudes of errors depend on the accuracy of input data, particularly from the burnup calculations. They should meet the requirements made by long-term planning; further improvements seem to be possible. 6 references. (auth)

13156 CONSTRUCTION, FABRICATION AND ASSEMBLY OF STEAM GENERATORS, VALVES AND PIPINGS IN NUCLEAR POWER STATIONS. P. 1. Franzmann, K. (Deutsche Babcock und Wilcox Dampfkessel-Werke A. G., Oberhausen (F. R. Germany)). Betr.-Oekon.; 25: No. 8, 150-153(Aug 1972). (In German).

8 figs.; 1 tab.

An attempt is made to describe the fabrication and assembly of steam generators, piping, and accessories for nuclear power plants. The steam generators of the Biblis reactor are discussed to illustrate the procedures and problems. The description is given in the order of which the actual procedures took place or will take place. (GE)

13157 CONSTRUCTION, FABRICATION AND ASSEMBLY OF STEAM GENERATORS, VALVES AND PIPINGS IN NUCLEAR POWER STATIONS. P. 2. Franzmann, K. (Deutsche Babcock und Wilcox Dampfkessel-Werke A. G., Oberhausen (F. R. Germany)). Betr.-Oekon.; 25: No. 9, 174-177(Sep 1972). (In German).

13 figs.

13158 CONSTRUCTION, FABRICATION AND ASSEMBLY OF STEAM GENERATORS, VALVES AND PIPINGS IN NUCLEAR POWER STATIONS. P. 3. Franzmann, K. (Deutsche Babcock und Wilcox Dampfkessel-Werke A. G., Oberhausen (F. R. Germany)). Betr.-Oekon.; 25: No. 10, 184-187(Oct 1972). (In German).

9 figs.; 1 tab.

13159 THERMAL SLEEVE FAILURE AND REPAIRS-INDIAN POINT NO. 1 NUCLEAR UNIT (285 MW). Flynn, A.; Nelson, W.; Warner, W.; McCormick, D. (Consolidated Edison Co., Inc., New York). Nucl. Technol.; 25: No. 1, 13-31(Jan 1975).

During the course of plugging leaking tubes in the No. 12 steam generator at Indian Point #1, fragments of a thermal sleeve were found in the primary side of the steam generator water box. It was concluded that the failure of the sleeve and the internal cracking of the primary coolant pipe were both caused by thermal fatigue. No evidence of deficiency in the material properties of the sleeve or the pipe was disclosed. Repairs were made by installing a sweepolet fitting and a thermal sleeve of improved design. Thermal sleeves in other lines were examined to ensure their integrity. During this repair health physics was extensively involved because of the large number of mechanics engaged, many of whom were unfamiliar with radiation safety practices, the long periods of work in high radiation areas, and the need to keep accurate up-to-date exposure records on each man. To be certain that the full extent of the problem was understood, and that the repairs were satisfactory, a detailed quality assurance program was instituted and implemented. This program included certification of all materials and NDT personnel, the qualification of personnel such as welders and of all procedures including welding, NDT, and special plant operations associated with the repairs. (auth)

13160 INSULATION AND COOLING SYSTEM FOR A NUCLEAR REACTOR CONDENSER COMPARTMENT. Weems, S. J.; McCurdy, H. W.; Johnson, J. W. (to Westinghouse Electric Corp.). US Patent 3,844,885. 29 Oct 1974. Filed Date 29 Apr 1969. 6p.

The condenser compartment of a reactor containment is so insulated and cooled that a large quantity of a fusible material, such as ice, can be maintained in a solid state within the compartment for long periods of time. Mass transfer of the material due to sublimation and frosting is minimized by the insulation and cooling system provided, thereby achieving long term storage of the material with a reasonable and economical cooling system. (Official Gazette)

13161 FLOW TWISTER FOR A NUCLEAR REACTOR. Bevilacqua, F. (to Combustion Engineering Inc.). US Patent 3,847,736. 12 Nov 1974. Filed Date 24 Jan 1972. 6p.

A flow twister is described for coolant fluid flowing longitudinally in channels between spaced parallel nuclear reactor fuel rods positioned laterally by a grid of intersecting grid members extending transversely of and between the rods. The twister is a twisted metallic tab of cruciform cross section positioned at a grid intersection and located in and extending longitudinally of a channel and having one end secured to a grid and the other end free. (Official Gazette)

13162 NUCLEAR REACTOR SAFETY SYSTEM. Schluderberg, D. C. (to The Babcock and Wilcox Co.). US Patent 3,847,735. 12 Nov 1974. Filed Date 12 Dec 1972. 6p.

An improvement in the method and apparatus for suppressing vapor pressure buildup within a nuclear reactor containment structure housing a pressurized water nuclear reactor and steam generating equipment during a loss of coolant accident is described. The improved method comprises continually maintaining the temperature of the primary coolant within the primary coolant system below the saturation temperature of the primary coolant corresponding to the pressure then prevailing within the primary system during the accident. The novel apparatus provided for practicing the method includes a source of an emergency coolant and equipment for serially injecting separate portions of the emergency coolant from the source into the primary coolant system, each portion being injected in response to a separate corresponding predetermined value of a characteristic of the primary coolant system. (Official Gazette)

13163 MEANS FOR ADJUSTABLE CLAMPING SKIRT BETWEEN PRESSURE VESSEL AND CORE. Thome, P. (to Babcock-Atlantique, S. A.). US Patent 3,850,795. 26 Nov 1974. Filed date 1 May 1972. 6p.

Pads are joined to the inside surface of the pressure vessel in a nuclear reactor system, preferably through an electron beam welding process. Screw jacks fitted on the skirt within the pressure vessel engage the pads. The shapes of the pad bearing surfaces allow a longitudinal displacement of the reactor structure in response to thermal conditions. The novel features of the invention, moreover, eliminate skirt vibration and the requirement for high-precision construction. (Official Gazette)

13164 LEAKPROOF CONNECTION MEANS BETWEEN HOOP AND NOZZLE OF PRESSURE VESSEL. Thome, P. (to Babcock-Atlantique, SA). US Patent 3,850,796. 26 Nov 1974. Filed date 10 May 1972. 6p.

Illustrative embodiments of the invention are directed to the structure within a pressure vessel for a nuclear reactor. Sealing rings are placed against the seats of the pressure vessel discharge nozzles. These rings are field-fastened to the structure through distortionless electron beam welding. These seals are flexible and do not apply uncontrollable stresses to the pressure vessel while establishing a leak-tight condition between the inlet and outlet coolant flow at any anticipated reactor temperature. This invention eliminates the usual core barrel and pressure vessel machining operations and, additionally, insures the necessary leak-tight joints at working temperatures. (Official Gazette)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstract 13392.

13165 (GA-A-12946) GASEOUS RADIOACTIVITY LEVELS IN THE PRIMARY COOLANT OF AN HTGR. Haire, M. J.; McEachern, D. W. (General Atomic Co., San Diego, Calif. (USA)). 1 Oct 1974. 58p. (GA-LTR-14).

The technical basis used to establish gaseous fission product inventory in the primary coolant of a high-temperature gas-cooled reactor (HTGR) is given. Also, the procedure used to calculate fuel body and plateout fission product inventories is presented. The fuel particle coating failure model used to determine core-average failed fuel particle coating fractions is discussed. A summary of data describing fractional release of gaseous fission products from the fuel is presented. The temperature dependence of gaseous release is discussed. Calculations of coolant, fuel body, and plateout inventories of ^{137}Xe and ^{137}Cs for a 2000 MW(t) HTGR are given as examples of inventory calculations. (auth)

13166 (GA-A-13010A(Amend.1)) GENERAL ATOMIC QUALITY ASSURANCE PROGRAM. (General Atomic Co., San Diego, Calif. (USA)). Sep 1974. 75p. (GA-LTR-11(Amend.1)).

The quality assurance program to be implemented during the design, procurement, manufacturing, construction, and testing phases of a HTGR nuclear steam supply system is presented. (LTN)

13167 (JUL-Conf-10, pp 403-429) HTR FUEL ELEMENT TESTING IN THE MATERIAL TEST REACTOR R-2 AT STUDSVIK. Krawczynski, S. (Kernforschungsanlage, Juelich, Ger.); Krug, W.; Sandklef, S. Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

HTR fuel element performance tests carried out in the R2-reactor at Studsvik are described. The Studsvik R2-reactor is a 50 MW general purpose materials testing reactor which has been in operation since 1961. It has been used for several years as an irradiation testing facility for HTGR fuel. Experimental programs at Studsvik have originated mainly from the KFA development work on the THTR-300 reactor and from the OECD DRAGON-Project in the UK. The irradiation tests performed at Studsvik range from basic studies of coated particle behavior as function of temperature, burnup, and fast neutron fluence to integral testing of full size fuel elements for the THTR-300. To fulfil the different requirements of these tests a variety of irradiation devices have been designed. The continuous development of experimental rigs has been followed by design and operation of simple and reliable gas sweep circuits. These are connected to more sophisticated analyzing tools for maximum extraction of relevant data on the fission product release behavior of the fuel under irradiation. (auth)

13168 (ORNL-TM-4539) RELEASE OF FISSION PRODUCTS FROM PYROCARBON-COATED HTGR FUEL PARTICLES DURING POSTIRRADIATION ANNEALS. Morgan, M. T.; de Nordwall, H. J.; Towns, R. L. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 116p. Dep. NTIS $5.45.

The data, results, and evaluations of postirradiation annealing studies of coated HTGR fuel particles are reported. The purpose of the studies was to compare the capability of various pyrocarbon coatings for retaining fission products, including strontium, barium, and cerium, but primarily cesium. Experimental methods for annealing and examining coated particles are discussed. Constant-potential diffusion equations were used to calculate diffusion coefficients and the concentrations in the outer coating at the buffer-to-outer-coating interface. The results revealed kernel trapping effects and have indicated the possibility of a cesium concentration limit of $\sim 2 \times 10^{19}$ atoms/cm^3 in low-temperature-deposited isotropic pyrocarbon coatings of high density. Diffusion coefficients for cesium in the low-temperature-deposited isotropic pyrocarbon coatings were found to be an order of magnitude higher than in high-temperature-deposited isotropic pyrocarbon coatings. The diffusion coefficients obtained will be useful in determining the maximum cesium release from similar coated particle fuel during irradiation. Data concerning a trapped fraction and a concentration limit can direct further research which might provide more accurate estimations of cesium release from coated particles during irradiation. (auth)

13169 (RD/B/N-2787) COMBINATION OF MEASUREMENT AND PREDICTION TO OBTAIN BEST ESTIMATES OF RATING DISTRIBUTIONS IN CAGR STRINGERS. Dawson, J. T. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Aug 1974. 26p. Dep. NTIS (U. S. Sales Only) $4.50.

Gamma scanning measurements on CAGR fuel will form part of a detailed correlation program aimed at improving the calculational methods used in predicting rating distributions. Before completion of the correlation program, best estimates of rating distributions will still be required in the interpretation of post irradiation measurements such as fission gas releases. A method of obtaining these best estimates from a combination of measurement and prediction is described. The measured distribution of a given gamma emitting fission product in a fuel stringer is used to determine the corresponding rating distribution time-averaged over a few half-lives before discharge, and this involves the use of rating predictions to correct for the effects of time-dependent rating changes. Using subjective judgements for the uncertainties in CAGR rating predictions, it is shown that ^{140}Ba, ^{95}Zr and ^{95}Nb will yield, within a stringer, rating distributions to better than ±3% averaged over periods of typically 1, 6 and 9 months respectively, and that the long-lived fission product ^{144}Ce will yield relative ratings, or burn-ups, averaged over periods of less than 3 years, to better than ±4½%. (auth)

13170 PEBBLE BED REACTOR. Rohr, F. (to Siemens A. G., Berlin (F. R. Germany); Siemens A. G., Muenchen (F. R. Germany)). German(FRG) Patent 2058158/B/. 17 Jan 1974. 2p. (In German).

2 figs.

A description is given of a spherically formed fuel element for a pebble bed reactor which is provided with a coated cladding jacket and is centrally placed in a spherically formed, perforated cladding for the penetration of the coolant. The centering is obtained by proturberances (warts) of the gas-tight cladding jacket which lie on the inner wall of the perforated cladding. (GE)

13171 FUEL ELEMENT FOR GAS-COOLED REACTORS. Turner, R. F.; Winkler, E. O. (to USAEC, Washington, D. C.). German(FRG) Patent 1514961/B/. 3 Jan 1974. 4p. (In German).

5 figs.

A longitudinally extended hollow cylindrical fuel element is described which contains coated fuel particles in a matrix with pyrolitic carbon. In order to produce a local turbulence in the coolant flow, the exterior jacket surface of the fuel element is roughened or it has a graphite tissue. Orientation and construction of this tissue are discussed. (GE)

13172 EXPERIENCE IN CONSTRUCTION AND DEVELOPMENT PROSPECTS FOR NUCLEAR POWER PLANTS WITH GAS-COOLED HIGH-TEMPERATURE REACTORS. A Review. Arch. Energiewirt.; 28: No. 17, 870-877 (Sep 1974). (In German).

1 tab.; 23 refs.

Following a short introduction into the details of the HTGR type reactor, a review of the present state of development in Great Britain, the United States, and in Japan is given. (GE)

13173 WHAT INFLUENCE CAN THE HIGH-TEMPERATURE REACTOR HAVE ON THE INFRASTRUCTURE. Schulten, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). VGB Kraftwerkstechnik; 54: No. 9, 585-587 (Sep 1974). (In German).

The high temperature reactor permits the linking of raw materials and energy by means of the combined application of coal and nuclear energy. Extended implementation of this technology requires an enlargement of the infrastructure, for example, reprocessing plant, refabrication plant and also intermediate and permanent storage facilities for radioactive materials. One favorable feature of the integrated system from the safety point of view is the concentration of nuclear reactors and the nuclear infrastructure in energy centers. (auth)

13174 METHOD FOR DETERMINING THE PROPORTION OF BROKEN PARTICLES IN THE FUEL COMPACTS EMPLOYED IN HIGH TEMPERATURE REACTORS. Chenebault, P.; Pointud, M. L. (to Commissariat a l'Energie Atomique). US Patent 3,842,283. 15 Oct 1974. Priority Date 7 Jun 1972, France. 4p.

A method is described for determining the proportion of broken particles before, during, and after irradiation in fuel compacts consisting of particles dispersed in a graphite matrix, each compact being formed by a kernel of fissile material surrounded by a fission-product retention coating. The method consists in placing the compacts to be tested in a neutron flux together with reference compacts which contain a known number of uncoated kernels of fissile material, in entraining the fission gases released from the broken particles and uncoated kernels in a stream of inert gas or in a vacuum, in trapping the gases, in measuring the quantities of said gases by comparing the results obtained from the reference compacts and from the compacts to be tested and in deducing the proportion of broken particles. (Official Gazette)

13175 METHOD OF, AND APPARATUS FOR, SUPPORTING THE MODERATOR STRUCTURE OF A NUCLEAR REACTOR. Degen, R.; Zimmermann, M. (to BBC Brown Boveri and Co. Ltd.). US Patent 3,841,965. 15 Oct 1974. Priority Date 15 Oct 1971, Switzerland. 4p.

The moderator assembly of a gas-cooled nuclear reactor is supported by a replaceable supporting structure. (Official Gazette)

13176 GAS-COOLED NUCLEAR REACTOR. Laurer, E.; Schabert, H. P. (to Siemens Aktiengesellschaft). US Patent 3,850,794. 26 Nov 1974. Filed date 8 Mar 1972. 8p.

Gas-cooled nuclear reactor includes a grid-like core support plate having a plurality of cells and a group of at least nine fuel elements of elongated prismatic shape combined together and suspended substantially vertically at the upper end. The fuel elements are exchangeable from above the support plate. (Official Gazette)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 13124, 13268, and 13398.

13177 (IFA-DNBR-11-1974) NERO: CODE FOR HEAVY WATER REACTOR CELL. Part I-A. Cristian, I.; Cirstoiu, B.; Badescu, A.; Boeriu, S.; Cepraga, D.; Csiki, I. E.; Cimporescu, D. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 33p. (In Rumanian). Dep. NTIS (US Sales Only) $4.75.

The NERO code for heavy water reactors is presented. The physics models on which it is based are described in detail. The data library, input data, and output data are summarized. (JSR)

13178 (JUL-Conf-10, pp 78-101) TECHNICAL FEASIBILITY AND ECONOMIC POTENTIAL OF SPIKING D_2O-REACTORS WITH PLUTONIUM FUEL BUNDLES. Maerkl, H.; Raum, H. (Siemens Aktiengesellschaft, Erlangen, Ger.). Dec 1973.

From 2nd Indo-German seminar; Julich, F. R. Germany (18 Sep 1972).

The use of plutonium fuel elements as a means of increasing burnup and reducing fuel cycle costs in PHWR reactors of the Atucha type is considered, with the plutonium being concentrated in a limited number of elements. The physics considerations are discussed, and design specifications and fuel management optimization are discussed. (DG)

13179 FUGEN PROJECT. Shima, S.; Sawai, S. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Energ. Nucl. (Milan); 21: No. 12, 679-684(Dec 1974).

A short description is given of the main design characteristics of FUGEN, a 165 MW(e), heavy water moderated, boiling light water cooled prototype reactor. FUGEN has been developed and is being built in Japan by the Power Reactor & Nuclear Fuel Development Corp. 5 references. (auth)

13180 COMMERCIAL STEAM GENERATING HEAVY WATER REACTOR (SGHWR). Rippon, S. E. Energ. Nucl. (Milan); 21: No. 12, 672-678(Dec 1974). (In Italian).

After prolonged argument the British Government has decided to adopt the Steam Generating Heavy Water Reactor (SGHWR) for a programme of about 4000 MW(e) of power plant construction. Reactor-turbine units will be of 660 MW(e) gross capacity, involving no extrapolation of current practice for the electricity generating boards. A description of the features of the 660 MW(e) design is presented, putting in evidence that the variations of the main operating parameters between this and the 100 MW(e) SGHWR prototype at Winfrith are reduced to a minimum. (auth)

13181 MATERIAL TEST OF PRESSURE TUBES FOR ADVANCED THERMAL REACTOR. Hayashi, K.; Tsunoda, N.; Aoki, T.; Miura, M.; Obara, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Doryokuro Giho; No. 9, 37-49(Dec 1973). (In Japanese).

The outline of various material tests on heat-treated Zr-2.5% Nb alloy is described, which will be used as the material of pressure tubes of advanced thermal reactors. The tests include out-of-core tests and irradiation tests using JMTR. The preparation of test pieces is briefly explained first. The out-of-core tests include simple tensile test, ring tensile test, burst test, corrosion test, creep test, low-cycle fatigue test, etc. These tests were performed both at room temperature and at 300°C. The results of these tests are presented together with the experimental facilities used. For the purpose of comparison, the results of cold-worked alloy are also presented. To see the effect of neutron irradiation, almost same material tests were done on the test pieces irradiated by about 10^{21} nvt. Finally, the monitoring programs with the prototype advanced thermal reactor are reviewed. The first program is the use of special fuel assemblies containing test pieces. The second program is the non-destructive inspection of some of the pressure tubes of the prototype reactor. (JA)

13182 PROGRAM OF CONSTRUCTION OF THE HEAVY-WATER POWER REACTOR-"SIREN". Ushakov, B. A. At. Tekh. Rubezhom; 2: 3-15(Feb 1974). (In Russian).

Short review of articles published in Energ. Nucl. (Milan), 1973, v. 20(4).

A reactor prototype is described, constructed by the Siren program. The purpose of the project is to build a power channel reactor with natural U, with heavy-water moderator and ordinary boiling water as coolant. Construction of the prototype will allow testing the engineering involved in the project. The active zone of the prototype should be examined as a full-scale model of the active zone of a power reactor although the latter may require a closer grouping of the channels and data recorders for intra-reactor control. (INIS)

13183 EXPERIENCE OF CONSTRUCTION OF MADRAS ATOMIC POWER PROJECT. Srinivasan, M. R. (Madras Atomic Power Project, Kalpakkam, India). pp 45-67 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

Design changes adopted at MAPP relative to RAPP designs are described together with the design changes arising from operating experience at Douglas Point and design features dictated by special conditions of the site. Problems dealt with in the construction of the reactor building, including those in the foundations and in the prestressed concrete perimeter wall, are described. The site conditions gave rise to certain unusual problems which required unique solutions. Experience in other areas of construction in the reactor, turbine, and service buildings are also described. The problems of execution of the approach jetty, intake structure and tunnel are also described. Based on the experience at Kalpakkam, various suggestions for modifying the existing designs for a future station are discussed. (auth)

13184 CONCEPTUAL DESIGN OF THE MODIFIED 200 MW(e) REACTOR FOR NARORA. Kati, S. L. (Power Projects Engineering Div., Bombay). pp 105-124 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

The modified design concept that is being adopted for the Narora Atomic Power Project is described. Various objectives of the modified design of the reactor are high-lighted, such as manrem savings, reduced amount of equipment within the reactor building, reduction in capital cost, attempted reduction in reengineering manhours within the reactor building by avoiding the mirror image concept for additional units, and scaling up the design concept to 500 MW(e). (auth)

Power Reactors, Breeding

Refer also to abstracts 11456, 11949, 13271, 13274, 13315, 13324, 13332, 13333, 13338, 13357, 13383, and 13388.

13185 (ANL-8090) TWO-DIMENSIONAL FLUID-HAMMER ANALYSIS BY THE METHOD OF CHARACTERISTICS IN A CLOSED AXISYMMETRIC CYLINDRICAL DOMAIN. Shin, Y. W.; Valentin, R. A. (Argonne National Lab., Ill. (USA)). Aug 1974. Contract W-31-109-eng-38. 79p. Dep. NTIS $5.45.

A numerical-integration technique, based on the method of characteristics, is formulated for the system of quasi-linear hyperbolic equations describing fluid-hammer phenomena in a closed two-dimensional axisymmetric domain. The set of non-linear partial differential equations is first converted to a system of integral equations written along bicharacteristics. The solution is constructed in a step-by-step procedure by approximating the integral equations by the trapezoidal formula and using the resulting difference relations along four bicharacteristics and one streamline through each point. Spatial derivatives of the dependent variables are eliminated from the difference relations. The solution at any point then is obtained explicitly by a linear combination of the remaining difference relations. The method is programmed for an unsteady motion of liquids in a closed system. The one-dimensional fluid-hammer computer program NATRANSIENT is incorporated, and the combined program is capable of performing a two-dimensional analysis in any one

section of a complex system while treating the remaining sections as one-dimensional. As an example of the use of the program, sample problems of a simple geometry are computed and discussed. One-dimensional calculations for these same problems are compared. (auth)

13186 (ANL-CT-75-16) EQUATION OF STATE FOR STEAM BASED ON THE 1968 IFC FORMULATION FOR SCIENTIFIC AND GENERAL USE. Daley, J. G. (Argonne National Lab., Ill. (USA)). Nov 1974. Contract W-31-109-eng-38. 81p. Dep. NTIS $7.25.

A computer code has been written to calculate the equilibrium properties of subcooled water and superheated steam based on the 1968 IFC formulations. The equations of state described herein cover ranges most commonly used but do not cover the entire region for which equations of state have been written. The code is devised in the form of subroutines which have as input two independent state variables. The subroutine will then calculate a dependent variable and the first and second derivatives of the dependent variable as a function of the two independent variables. The Gibbs function is the dependent variable in the compressed liquid region, and the Helmholtz function in the superheated vapor region. Simple thermodynamic relations then give other variables such as enthalpy, entropy, specific heat, sonic velocity, internal energy, etc., in terms of these calculated functions and their derivatives. This scheme enables the user to adapt the subroutines easily to his particular application by using the calculated derivatives to write efficient iteration routines to calculate water properties in terms of his own choice of independent variables. (For example, if the independent variables actually used by the subroutine are pressure and temperature, but the user has internal energy and density available, then an iteration program giving pressure and temperature as a function of internal energy and density is easily written.) (auth)

13187 (ANL/EBR-085) EBR-II BURNUP AND FLUENCE HISTORY I. Part 2. Calculations. Larson, H. A.; Walker, P.; Sullivan, J. E.; Phillips, K. E.; Meneghetti, D. (Argonne National Lab., Ill. (USA); Argonne National Lab., Idaho Falls, Idaho (USA)). May 1974. Contract W-31-109-eng-38. 507p. Dep. NTIS $28.50.

Summarized results from the detailed EBR-II Burnup and Fluence History I calculations through EBR-II run 55 have been compiled. The method used has been published in ANL/EBR-084. Calculated burnups for many EBR-II driver-fuel elements are compared with experimental values. Values for incremental and accumulated burnup and fluence calculated for each reactor run are presented for each subassembly throughout its life in the reactor. (auth)

13188 (ANL-Trans-966) METHOD OF CLADDING RUPTURE LOCALIZATION BY TRACER GASES: EXPERIENCE ACQUIRED AT CEA. Boyer; Chantoin; Jarretou, H.; Pages, J. P. 1974. Translation of Methode de Localisation des Ruptures de Gaine par Gaz Traceurs: Experience Acquise au CEA. 13p. Dep. NTIS $4.00.

The experience acquired at CEA in the past 4 years allowed the exploration of different areas of the cladding rupture localization method with tracer gases: gas feed, influence on cladding, data transfer, instrumentation, etc. Application of the method to RAPSODIE is promising: expansion of the labeling method to the complete core which is in progress should confirm its efficiency. As a supplement to this statistical experiment, it seems necessary to test labeling in a complete PHENIX core in order to evaluate the competitiveness of tracers in reactors of industrial size. (auth)

13189 (CONF-741114-1) LMFBR STEAM GENERATOR MATERIAL SELECTION, DEVELOPMENT PROGRAM, AND TEST RESULTS. Hoffman, E. E.; Patriarca, P.; Spalaris, C. N.; Wright, E. A. (Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From Joint US/USSR steam generator seminar; Los Angeles, California, USA (Nov 1974).

Information on the properties of Cr–Mo steels being considered for LMFBR steam generators is presented. Tensile, yield, creep and stress-rupture strengths of these steels with varying carbon content and different heat treatments are being determined at 900°F (the required operating temperature) in order to provide reliable values for design purposes. The possible effects of decarburization of a surface layer on creep are being studied at 950°F with cyclical loads. (LTN)

13190 (JUL-Conf-10, pp 436-462) IRRADIATION FACILITIES FOR THE DEVELOPMENT OF FAST BREEDER FUEL PINS. Bojarsky, E. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Irradiation capsules used in the BR-2 and the FR-2 reactor in studies of LMFBR cladding, structural materials, and fuels are described. The helium cooled loop system in the FR-2 reactor is described. (DG)

13191 (JUL-Conf-10, pp 463-490) IRRADIATION TESTING OF VENTED FUEL ELEMENT-BUNDLES FOR GAS-COOLED FAST BREEDERS. Krawczynski, S. (Kernforschungsanlage, Juelich, Ger.); Krug, W.; Stechemesser, H.; Jung, W.; Knaab, H.; Stehle, H. Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Performance testing of GCFR type vented-fuel elements will be done in a BR-2 reactor loop converted from CO_2 to helium cooling. The loop as rebuilt will have a cadmium-shielded test-section producing an epithermal neutron spectrum resulting in power and temperature distributions equivalent to those in a GCFR. Fast flux effects, however, will not be present. The experiments will include GCFR multi-rod bundle irradiations under dynamic He-coolant conditions and in-pile operation of the GCFR pressure equalization and fission-gas venting system. A first irradiation during one BR2-cycle will be used to qualify the loop facility and to assure correct operating conditions for the second, long-term irradiation with a target burn-up of 60,000 MWd/t to 100,000 MWd/t. (auth)

13192 (WARD-OX-3045-5(Add. 3)) REVISED DATA PACKAGE TO EXTEND GOAL BURNUP TO 12 PERCENT IN EBR-II GRID-TYPE SUBASSEMBLY WSA-3. Addendum 3. Schenone, C. E. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1974. Contract AT(11-1)-3045. 44p. AT.

An experiment description and a safety analysis for extending the WSA-3 subassembly burnup to 12% are presented. (JWR)

13193 DESIGN, CONSTRUCTION, AND COMMISSIONING OF PFR AS AT 14 DECEMBER, 1974. Evans, A. D. (United Kingdom Atomic Energy Authority, Dounreay, Eng.); Laithwaite, J. M.; Nunn, D. A. pp 1-11 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The design of PFR has been described by Campbell et al. (Sodium cooled fast reactor engineering; Proceedings of an IAEA Symposium, Monaco, March 1970) and Moore et al. (The Dounreay Fast Reactor; Nuclear Engineering International, August 1971). The first part of the commissioning program is discussed; a brief review of the final stages of construction is presented. Critical path planning was used extensively throughout the design, supply, construction and testing stages to provide the best possible cost and programme control. In general the primary circuit construction activities set the critical path. (auth)

13194 FOUR YEARS' OPERATING EXPERIENCE ON THE EXPERIMENTAL BOR 60 NUCLEAR POWER STATION. Gryazev, V. M.; Krasnoyarov, N. V.; Kevrolev, V. P.; Kondrat'ev, V. I.; Nechaev, B. N.; Smirnov, A. M. pp 21-26 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A brief survey is given of the more important results obtained in four years operating experience with the experimental BOR 60 nuclear power station. Results of investigations into various fast reactor problems are presented. Attention is paid to difficulties occurring in the course of operation. (auth)

13195 RESULTS OF RESEARCH AND EXPERIENCE OF NUCLEAR POWER STATION STARTUP WITH THE BN 350 REACTOR. Mitenkov, F. M.; Orlov, V. V.; Yurchenko, D. S.; Bagdasarov, Yu. E.; Baklushin, R. P.; Kiselev, G. V.; Kochetkov, L. A.; Kuznetsov, I. A.; Pakhomov, V. V.; Ushakov, A. V.; Vasilenko, K. T. pp 27-32 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The first large-scale industrial nuclear power station employing a fast reactor was brought into commission on 16 July, 1973 at Shevchenko in the Kazakh SSR. Startup of this plant represents the culmination of almost 25 years work in the USSR on fast breeder reactors. The results of investigations, together with operating experience during the period of startup and running-in during the early months following commissioning up to 30% capacity, are presented. These results indicate that all the equipment of the reactor installation itself and the sodium circuits are functionally sound, reliable, and stable. At the same time the startup and the initial operating period brought out a number of difficulties, retarding takeover of the plant. (auth)

13196 DESCRIPTION OF PHENIX. Megy, J.; Crette, J. P.; Labat, P.; Robert, E. pp 33-35 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Phenix power plant characteristics are summarized. A brief account is presented of the planning and organization of tests and the coordination of the experimental results with the construction and start-up schedule. Tests of plant components such as steam generators, and some aspects of the design of the cooling system, are mentioned as examples. (UK)

13197 PHENIX SURVEY OF COMMISSIONING AND STARTUP OPERATIONS. Guillemard, B.; Marechal, T. L. pp 37-49 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Phenix startup operations and tests are now in their ending phase. It should be noted that the first on-site sodium deliveries—leading to the first tests—came during July 1971. Main circuits sodium fill took place during December 1972 and January 1973, the first criticality occurred at the end of August 1973, and power build up started at the end of October 1973, while the first coupling to the grid took place on 13 December 1973. The importance of PHENIX startup tests relates to the distinctive prototype character of the power plant, and also to its dimensions. Test aims were to insure the facility progressive and sequential operational start while minimizing the risks inherent in such prototype characteristics. Thus, all was evolved for the fullest series of tests—sodium tests, more particularly—before going through reactor criticality. This procedure enabled a relatively short delay between criticality and the first power build up. The organization that was set up for this purpose, the various startup steps as they were anticipated, of the actual sequence of tests on-site, and the important associated events are described. (auth)

13198 UNITED STATES LMFBR DEMONSTRATION PLANT ACTIVITIES. Behnke, W. B.; Crawford, J. W.; Jacobi, W. M.; Watson, J. E. pp 85-100 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The USA liquid metal fast breeder reactor demonstration plant will be located on a 1364-acre Tennessee Valley Authority (TVA) site on the Clinch River, adjacent to the United States Atomic Energy Commission's (USAEC) Oak Ridge operations reservation, about twelve miles southwest of mid-town Oak Ridge, Tennessee. This 975 MW(t) loop (piped) type installation, now officially designated as the Clinch River Breeder Reactor Plant (CRBRP), will feed 350 MW(e) into the TVA power grid starting in the early 1980s. A stand-alone plant on the Clinch River site was selected after previous consideration of alternative siting arrangements, including hook-on plants to two existing TVA power generation facilities, John Sevier and Widows Creek. Extensive Clinch River site investigations and evaluations are underway. Preparation of safety evaluation and environmental impact documents required for USAEC licensing reviews began in late 1972. (auth)

13199 BRIEF DESCRIPTION OF PLANNED PROTOTYPE FBR MONJU OF JAPAN. Miki, R.; Suzuki, Y.; Nakai, Y.; Nishikawa, Y.; Kawashima, K.; Odajima, K.; Kitagawa, H. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 101-104 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The design of the prototype fast breeder reactor "MONJU" in Japan has been in progress since 1967 with support of intensive research and development works. Review and evaluation on the construction plan of "MONJU" will be conducted by Japan Atomic Energy Commission in 1973 and it will be followed by the safety evaluation and the construction of the plant will be started in 1975. The commissioning will take place by spring 1980. (auth)

13200 SNR 300. Brandstetter, A. (INTERATOM, Bensberg/Cologne, Ger.); Engelmann, P.; Koop, W. pp 105-110 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The SNR 300 is the 300 MW fast breeder prototype reactor under construction within the framework of a joint German, Dutch, Belgian development program. The organizational basis of this program, the important design features, the progress of the construction and the related research and development program are described. (auth)

13201 PRELIMINARY DESIGN OF A POT-TYPE FAST BREEDER POWER STATION. Cecchini, G. P. (NIRA, Genoa); Moschella, U.; Musso, B.; Russo, S.; Viotti, V. pp 123-130 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Studies are presented for the preliminary design of a 1000 MW(e) LMFBR power station, taking the Phenix design as a basis. Proposals are made for the reactor layout and the core mechanical design. Special attention is paid to; a safety approach in agreement with Italian standards and laws; a preliminary evaluation of the main feasibility problems; and the attainment of a plant availability factor as high as possible. (UK)

13202 ITALIAN PROGRAMME OF SODIUM-HEATED STEAM GENERATORS. Casalini, P. (CNEN, Bologna); Saigo, C.; Gerosa, A.; Valentini, P.; Leo, S. D.; Avanzini, P. G.; Cavalleri, G. pp 137-149 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The project and the R & D programme of a straight-tube steam-generator for a 1200 MW(e) LMFBR power station are described. A helical tube steam-generator project is briefly mentioned. (auth)

13203 STEAM GENERATORS FOR THE MONJU POWER PLANT. Nakai, Y.; Watanabe, T.; Hoshi, Y.; Tanaka, K.; Hori, M.; Sano, A. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 151-156 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The steam generator is considered to be one of the key components in the LMFBR plant, since it is exposed to high temperature sodium and is subjected to the potential hazard of sodium-water reaction. The structural and functional features of the steam generators and a brief description of the related research and development for "Monju" are presented. (auth)

13204 OPERATIONAL EXPERIENCE WITH MAIN CIRCUIT COMPONENTS FOR THE SNR 300 POWER PLANT. Mante, A. J. H. (Neratoom, N. V.; The Hague); Braun, A. R.; Jansing, W. J.; Mausbeck, H. pp 157-171 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

To gain operational experience and to avoid start-up difficulties, it was decided early in the SNR-300 R & D Program to test essential components of the prototype plant under actual sodium conditions prior to the beginning of design and construction. Testing was carried out by Neratoom and Interatom, at the Interatom and the TNO research centers. The objectives of the research work were to determine component performance and reliability under specified operational conditions including controlled and uncontrolled dynamic behavior and thermal shocks. Meanwhile experience could be obtained with new sodium instrumentation. The test results have proved to be of prime importance, influencing the final design specifications of the SNR components. They also serve as a basis for the current licensing procedures and will serve as an aid to the forthcoming plant commissioning. At present, not all of the tests have been completed. Component testing is still in full operation. (auth)

13205 DEVELOPMENT OF SODIUM-HEATED STEAM GENERATORS IN THE NETHERLANDS. de Clercq, W. J. C. (Neratoom, N. V.; The Hague); Van der Krogt, C. A. J.; Ruyterman, C.; Ludwig, P. W. P. H.; Poiesz, M. J.; Broodman, J. J.; van den Boomen, N. A. pp 173-187 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The development of sodium-heated steam generators in the Netherlands since 1970/1972 is reviewed. Steam generators with a straight tube bundle as well as with those with helically coiled tube bundles, both types to be installed in SNR-300, are described. A development line for a steam generator design with a possibility for extrapolation to larger outputs per component is mentioned. The resulting 50 MW(t)-prototype steam generator with a helically coiled tube bundle is described. Adaptation of SNR-300 requirements for this prototype led to the design and construction of the steam generator with a helically coiled tube bundle for SNR-300. Some important aspects of the possibility to use the above mentioned types of steam generators in L(iquid) M(etal) F(ast) B(reeder) R(eactor)s, such as sodium-water reaction tests, test results of prototypes in the 50 MW-S(odium) C(omponent) T(est) F(acility) which led to modifications of design and construction, quality control and inspection of tube-welds and economic aspects of the eventuality of a sodium-water reaction in this type of steam generators, are briefly mentioned. (auth)

13206 MATERIALS SELECTION AND EXPECTED PERFORMANCE IN NEAR TERM LMFBR STEAM GENERATORS. Armijo, J. S.; Krankota, J. L.; Spalaris, C. N.; Norst, K. M.; Tippets, F. E. (General Electric Co., Sunnyvale, CA). pp 189-203 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Criteria used in the selection of materials for near term LMFBR steam generators are described. The primary criteria (fabricability and resistance to stress-corrosion cracking) are selected to provide maximum assurance against the initiation of sodium-water reactions. The secondary criteria (carbon transport, mechanical properties, wastage resistance, water/steam corrosion and sodium corrosion) are selected to minimize the propagation of sodium-water reactions and other design or operational penalties. Materials considered in the selection include stabilized and non-stabilized ferritic steels (2¼ Cr-1 Mo, 9 Cr-1 Mo) Incoloy-800 and other austenitic alloys. The results of development tests to rate the relative advantages of these materials, with respect to the selection criteria under prototypic and off-normal conditions, are described. (auth)

13207 PHENIX STEAM GENERATOR DEVELOPMENT AND PRELIMINARY OPERATION. Robin, M. G. (CEN de Saclay, Gif-sur-Yvette, France); Saur, J. M.; Schwab, B.; Lions, N.; Beaufrere, J.; Lecocq, P. pp 205-221 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Phenix is a 250 MW(e) Sodium-Cooled Fast Breeder Reactor Demonstration Plant whose first criticality was achieved on August 31 and which was tied to the French national grid on December 13, 1973. This three secondary loop plant works on a sodium reheat steam cycle which was selected mainly because it was felt desirable to utilize a standard 250 MW(e) turbine-generator set. It is equipped with 3 modular steam generators proposed by Stein Industrie Co. in 1966. These units were preferred because of their ease of fabrication and transportation, their expected good reliability, their ability to limit the consequences of sodium-water reactions, and also the possibility of testing a full scale module prototype. A report is presented on the experimental studies which were carried out at various French facilities prior to the erection of the Phenix Steam Generators, and also on their preliminary operation at the Marcoule Site. (auth)

13208 ERECTION AND TESTING OF PFR SECONDARY CIRCUITS AND STEAM GENERATORS. Taylor, D. (Nuclear Power Group Ltd., Risley, Eng.); Millican, B. P. pp 223-236 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The PFR steam generators are forced circulation units each of 224 MW(t) capacity, utilising separate "U" tube heat exchangers for evaporation, superheating, and reheating steam. Procurement has involved the utilisation of stringent quality control followed by careful testing including the use of water in the secondary circuit to simulate flowing sodium. The key features of the manufacturing activities including the methods used for in situ inspection and plugging of defective heat exchanger tubes are described. Experience on the water test is outlined and compared with the design predictions for sodium operation which led to the introduction of some modifications before sodium fill. (auth)

13209 RESULTS OF EXPERIMENTAL AND STARTUP ADJUSTMENT WORKS ON THE STEAM GENERATORS OF THE BN 350 INSTALLATION. Blagovolin, S. M.; Baklushin, R. P.; Fedorov, V. G.; Grdlichko, E. M.; Gubanov, V. M.; Logvinov, S. A.; Likasevich, B. I.; Nekrasov, A. V.; Stekol'nikov, V. V.; Yurchenko, D. S. pp 237-245 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The steam generators on the BN 350 installation, together with individual questions regarding the experimental justification, were first described in 1966, at the London conference on fast reactors. The natural circulation steam generators have steam parameters $P = 50$ kgf/cm^2 and $T_{st} = 435$°C. Each steam generator consists of a vertical evaporator with field tubes and a U-type steam superheater. In each loop of circuit 2, there are two evaporators and steam superheaters. The capacity of the steam generators on the one loop is 200 MW. The steam generators were manufactured during 1969-70, erected in 1971-2 and started operation in July 1973. (auth)

13210 COMPARISON OF THE THEORETICAL BASIC PHYSICAL CHARACTERISTICS OF THE BN 350 REACTOR WITH THE RESULTS OF MEASUREMENTS. Orlov, V. V.; Troyanov, M. F.; Matveev, V. I.; Gorbatov, N. E.; Zhukov, A. V.; Ivanov, A. P.; Koloskov, B. V.; Pshakin, G. M.; Savos'kin, M. M. pp 255-261 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A comparison is made of the basic physical characteristics of the BN 350 reactor in terms of critical mass, efficiency of the SUZ members, distribution of the heat release field, and reactivity temperature effect measured at the time of physical startup, with their theoretical values. New sets of computer programs were employed for the calculations, developed at the FEI. Results of Calculations are also set out according to these programs on a model reactor on the BFS rig. (auth)

13211 NUCLEAR PERFORMANCE OF MONJU. Suzuki, Y.; Kawashima, K.; Izumi, A.; Maeda, Y.; Suzuki, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 263-266 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The reactor core contains 196 hexagonal fuel assemblies in two enrichment zones and the core volume is about 2200 lit. The axial blanket elements are integrated into the core fuel elements, while 174 assemblies are placed in the radial blanket zone around the core. (auth)

13212 EXPERIMENTAL PHYSICS RESULTS AT STARTUP OF PHENIX. Clauzon; Coulon; Gourdon; Gouriou; Humbert; Martin; Mougniot; Sicard. CEN de Cadarache, Saint-Paul-les-Durance, France). pp 267-277 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Low power nuclear tests, steam and temperature check of the plant before connection to the grid and power rise tests were run from August 31, 1973 when Phenix went critical until February 1974. Measurements and results concerning the physical properties of the core, and their application to reactor operation are presented. The following topics are covered in turn: loading to criticality, and determination of the nominal power core; control rod calibration; core subassembly reactivity worth; fission rate distribution; isothermal temperature, flow rate and power reactivity coefficients; neutron control and the evolution of inherent and auxiliary sources; core thermal balance; and use of selected results in the CAPHE code for predicting neutron and thermal characteristics of core subassemblies (for each loading and during the operating cycle). A brief description of the Phenix installation is given to facilitate this discussion. (auth)

13213 REACTOR PHYSICS MEASUREMENTS OF SOME KEY PARAMETERS OF THE PFR. Smith, D. C. G.; Wheeler, R. C. (United Kingdom Atomic Energy Authority, Dounreay, Eng.). pp 279-290 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Preliminary measurements on the first core loading of the PFR included critical loadings, rod worths, rod interaction and the isothermal temperature coefficient. These have shown fair agreement with calculation to within the expected errors. There was also some indication that pressure and flow coefficients of reactivity may be small. A more precise reactivity scale will be established shortly which will help to refine the comparisons; but the preliminary conclusion is that nothing unexpected has been found in some key core parameters at low temperature. (auth)

13214 PERFORMANCE DEVELOPMENT OF THE PFR FUEL AND THE USE OF PFR AS A FUEL DEVELOPMENT FACILITY. Bishop, J. F. W. (United Kingdom Atomic Energy Authority, Risley, Eng.). pp 295-306 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The designs of the PFR core and radial blanket assemblies are described in relation to specific problems which call for consideration and possibly experimental work. Detailed discussion follows, on: fuel pin performance; void swelling; irradiation creep; cladding attack; fuel-coolant interaction; load changing. The use of PFR in the development of fast reactor fuel is discussed generally. (UK)

13215 SUPPORT OF PFR SUBASSEMBLIES AND ASSOCIATED DEVELOPMENTS. Holmes, J. A. G. (Nuclear Power

Group Ltd., Risley, Eng.). pp 307-318 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The PFR core contains a total of 78 fuel subassemblies plus a further 13 positions for absorber rods and experimental facilities, surrounded by a total of 126 breeder and reflector subassemblies. Diagrammatic layouts of the core and of a subassembly are shown. The design and development of the support system for this core and also the design of a facility which has been incorporated into PFR to enable a further type of support to be tested are described. (auth)

13216 INVESTIGATION OF THE BOR 60 REACTOR FUEL AND ABSORBING ELEMENTS. Krasnoyarov, N. V. pp 319-324 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The basic results from an investigation of the first charge of fuel elements on the BOR 60 reactor after 4, 5, 8 and 10% burnup are presented. The maximum integral flux was $\sim 8 \times 10^{22}$ N/cm^2. Conclusions are drawn regarding satisfactory performance of the fuel elements under conditions of maximal approximation to the parameters of industrial power plants. The performance is assessed of the BOR 60 reactor absorbing elements based on boron carbide. (auth)

13217 MAIN PROBLEMS IN DESIGN OF FAST REACTOR FUEL ELEMENTS WITH OXIDE FUEL. Golovnin, I. S.; Men'shikova, T. C.; Bibilashvili, Y. K. pp 325-334 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A progressive program is being carried out in the Soviet Union in bringing in fast neutron reactors. The first reactor with a capacity of 5 MW was started in 1957, BOR 60 (60 MW) was started up in 1969, during the summer of 1973 the experimental BN 350 industrial reactor (350 MW) started construction, and it is intended to start up the BN 600 during the coming Five Year Plan. The central problem in the design of a fast reactor is the development of a reliable fuel element operating under very stressed conditions. Successful operation of the BOR 60 reactor, the fuel elements of which were designed in accordance with power plant parameters, enabled certain results and power concepts to be applied to the main problems in the design of fast reactor fuel elements. Experimental results obtained also clarified previously unresolved problems, providing a more accurate representation of future fast reactor development. (auth)

13218 STATUS OF THE FUEL ELEMENTS FOR SNR 300 WITH CONSIDERATION OF THE TECHNICAL AND ECONOMICAL ASPECTS. Hoechel, J. (International Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Cologne, Ger.); Karsten, G.; Morelle, J. M.; Schmale, H.; Stoll, W.; Vanden Bemden, E.; Van Miegroet, J. pp 335-348 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A brief descriptive summary of the fuel concept of the SNR-300 reactor is given. The essential characteristics of the fuel pin, the fuel bundle and the fuel subassembly are provided together with the main theoretical and experimental support data. The fabrication of the mixed oxide pins will be performed in two plants which started operation in 1973. The fabrication processes and some of the associated manufacturing problems are discussed. The economics of the fuel are reviewed, with special emphasis on the reasons which lead to a larger pin diameter for the reloads as for the first core. (auth)

13219 PERFORMANCE OF FAILED FUEL IN FAST REACTORS. Bohaboy, P. E.; McWethy, L.; Spalaris, C. N.; Horst, K. M.; Craig, C. N. (General Electric Co., Sunnyvale, CA). pp 349-361 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Fuel rods designed with a conservative basis and fabricated with careful attention to quality should provide a high level of assurance against failure. However, despite careful attention to design and fabrication, not all failure mechanisms and their causes will be fully understood for sometime; therefore, reactor designers and operators require knowledge of the behavior of failed fuel and its effect on the safe operation and maintenance of reactor systems. Factors to be taken into consideration include: (1) rate and extent of fuel rod dimensional changes following failure; (2) quantity of fuel and fission products released to the primary reactor system and their effects on plant maintenance and operation; and (3) consequences of subsequent reactor operation with failed fuel in the core. General Electric has conducted experimental work and related analytical studies for the U. S. Atomic Energy Commission's LMFBR program. The experimental work has included in-pile investigations using both static capsules and forced circulation capsules. Measurements have been made on changes in fuel rod diameter as a function of fuel design characteristics, operating parameters, and time after failure. Data have also been obtained concerning the release of fuel and fission products from failed fuel. The results and conclusions of this work and the implications on LMFBR design, operation, and maintenance are discussed. (auth)

13220 EXPERIMENTAL PROGRAMME IN SUPPORT OF THE PEC CORE AND FUEL DESIGN. Barigozzi, M. (AGIP Nuclear, Milan); Amelotti, F.; Bruzzi, L.; Tabellini, P.; Bianchi, G.; Fizzotti, C.; Martini, M. pp 363-370 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The design criteria for the core of the PEC reactor and the theoretical and experimental work performed in support of the core design are outlined. The main points of the experimental program reported are: hydraulic testing on fuel elements, thermal-hydraulic testing in sodium, preliminary irradiation programme, experiments on the vibration behavior of the assembly of seven fuel elements and technological work in support of the fuel element fabrication. The design problems and the experiments in support of the PEC in-pile loops are also described. (auth)

13221 PHENIX CORE: DESCRIPTION AND FIRST OBSERVATIONS MADE DURING POWER SET-UP. Estavoyer, M. M.; Ginier, R.; Marmonier, P. L.; Skok, J.; Pontier, M.; Clottes, J.; Marcon, J. P. pp 371-381 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Following a description of the PHENIX equilibrium core, the PHENIX subassemblies, and the thermal, hydraulic and mechanical problems arising in connection with them are described. A description of the major experimental devices and special subassemblies used for the approach to criticality and the power set-up precedes an account of the initial results of some experiments made on the start-up core: pressure measurements made in the subassembly support grid; and preliminary core thermal balance at 380 MW(t). (auth)

13222 MONJU HEAT TRANSPORT SYSTEM. Nakai, Y.; Imanabe, N.; Watanabe, T.; Hoshi, Y.; Kurokawa, M. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 387-392 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The main characteristics of the 714 MW(t) "MONJU" heat transport system are described. The "MONJU" heat transport system consists of 3 loops: each loop has a primary loop, containing a vertical straight tube IHX, a cold leg pump and a check valve and also has a secondary loop containing a system of steam generators and a cold leg pump. The primary loop of the main heat transport system is shared by the auxiliary coolant system. (auth)

13223 THERMAL PERFORMANCE AND HYDRAULIC ACTIVITIES WITH RESPECT TO THE FAST BREEDER REACTOR DEVELOPMENT. Hoffmann, H. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe, Ger.); Hofmann, F.; Markfort, D.; Rehme, K.; Voj, P. pp 393-414 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The present state of thermohydraulic investigations with respect to fast breeder development is summarized. The investigations aim at preparing data on the optimal design of the reactor components, the most important being the fuel elements and the reactor core. (auth)

13224 THERMAL PERFORMANCE AND HYDRAULICS. Noel, H.; Branchu, J. pp 415-417 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The tests carried out with the PHENIX Nuclear Plant were isothermic test (no nuclear power), under temperature ranging between 150 and 450°C, neutronic tests under extremely low nuclear power and tests at a power level limited to 20% of the nominal power. Therefore, it is intended to publish the results

obtained from findings covering a period of 13 months over the primary and secondary circuits of the power plant, and this concerns thermal and hydraulic problems (including vibrations). (auth)

13225 SPECIFICATION, IMPLEMENTATION, AND USE OF THE PFR SIMULATOR. Arthorne, C. H. (Redifon Electronic Systems Ltd., Crawley, Eng.); Burke, P. M.; Cruickshank, A. M.; Hopkinson, A. pp 419-428 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The considerations that led to the decision to acquire a simulator for the PFR are discussed. The facilities provided and some of the problems solved in producing the simulator are also discussed. Finally, experience gained in the early use of the simulator and some of the benefits of this use are described. (auth)

13226 EXPERIMENTS IN MEASUREMENT OF DYNAMIC CHARACTERISTICS. Kuzentsov, I. A.; Antul'ev, O.; Buksha, Y. K.; Dvoryanskov, V. P. pp 439-443 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

During the startup period of the BN 350, a big programme of experiments was carried out on the measurement of the dynamic characteristics of the reactor and its systems for determining the behaviour of the plant under unstable and fault conditions and consequently reliability and safety in operation. The results of these experiments are now being treated. Experiments are described investigating hydraulic transient processes in the circuits of the plant, measuring the hydrodynamic effects of reactivity. (auth)

13227 PHENIX DYNAMIC BEHAVIOUR AND CONTROL. Acket; Chaumont; Jallade; Ladet; Decuyper; Martin. (CEN de Cadarache, Saint-Paul-les-Durance, France). pp 445-449 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The dynamic behavior of the fast reactor Phenix is closely linked: (a) to the specific characteristics of the plant: the reactor is of the pool type: three secondary loops carry the power to three modular once-through steam generators; and (b) to the choices made concerning operating modes: Phenix is a base load power plant; there are a certain number of safety automatisms, but no automatic control; the operator acts manually to set the primary and secondary flows and the control rod position. Dynamic studies have been performed since the early design period of Phenix; these studies are described. (auth)

13228 PEC REGULATION AND CONTROL SYSTEM. Ciriegi, U. (CNEN, Bologna); Giordano, P.; Mathis, A.; Melucci, G. pp 451-459 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

After a brief description of the characteristics of the PEC reactor relating to the control system the main features of the reactivity control and the operation requirements are outlined. The method and tools used for dynamical analysis and the control schemes adopted are described. Finally the design of the cooling circuits regulation and the specially developed neutron power controller are briefly discussed. (auth)

13229 SODIUM ANALYSIS AND PURIFICATION. Aerosols Trapping in PHENIX Reactor. Boutrais, M.; Champeix, L.; Chouard, P.; Dolias, M.; Tibi, A. (CEC de Cadarache, Saint-Paul-les-Durance, France). pp 465-480 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A description is given of the purification sampling and sodium purity survey components for Phenix circuits. There follows a general outline of the operation of these components and of observations made during the first tests in sodium before criticality and at the time of the reactor start-up, stressing the sampling program, analysis methods, and results obtained. Finally the way in which the sodium aerosols are trapped in the loops connected to the gas cover is discussed. (auth)

13230 IMPURITY MONITORING AND ANALYSIS IN PFR. Davies, R. A.; Robertson, C. M. (United Kingdom Atomic Energy Authority, Dounreay, Eng.). pp 481-486 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

It is an essential part of reactor operation that as far as possible changes in coolant and cover gas chemistry should be recognized and related to other changes which may arise. The chemical monitoring arrangements in PFR and the experience which has been obtained during the commissioning of the system are described. (auth)

13231 IMPURITY MONITORING TECHNIQUES FOR LMFBR SODIUM SYSTEMS. Haubold, W.; Jung, J. (INTERATOM, Bensberg, Ger.). pp 487-496 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Continuously indicating devices for the determination of oxygen, hydrogen and carbon in sodium have been developed which are particularly suited for the surveillance of sodium cooled reactor systems. Additional information regarding the purity of sodium is gained by the chemical analysis of sodium samples taken from the system by an in-line sampling and distillation procedure. Using these methods it is possible to specify and to monitor the maximum allowable content of impurities in reactor systems more precisely than could be done till now, e.g., by only specifying the plugging temperature. (auth)

13232 FUEL FAILURE AND INSTRUMENTATION ON LMFBRs' SAFETY. Nishikawa, Y.; Kawaguchi, O.; Mimoto, Y.; Saito, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 497-504 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Causes and countermeasures of local fuel failure and propagation, which is one of the important subjects on LMFBR's safety, are examined. A minor fault in a fuel assembly means fuel pin failure resultant from a shortage of local cooling capacity. How the minor fault in a fuel assembly affects the surrounding channels thermohydrodynamically and what signal it gives to the core outlet temperature sensors and flow sensor are studied analytically. Characteristics of temperature and flow sensors which are to be installed in Monju are investigated. R & D activities of detectors are mentioned, and further, it is explained that they are expected to satisfy the miniumu requirements on reactor safety. (auth)

13233 ULTRASONIC AND ACOUSTIC DETECTION METHODS FOR LMFBRs. Rohrbacher, H. A.; Bartholomay, B. (Gesellschaft fuer Kernforschung m.b.H.; Karlsruhe, Ger.). pp 505-513 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The behavior of core components under sodium under various operating conditions greatly influences the safety of a reactor. Besides a number of well known methods of measurement acoustic measurements are becoming more and more important and are presently numbered among the most promising methods of early detection of coolant disturbances. Such methods include the detection and location of local coolant boiling in the core, the detection of gas bubbles and obstacles, the monitoring of pump noise, e.g., for cavitation, as well as positioning and scanning devices for fuel element loading and unloading. A major contribution is expected to be made also in the field of component handling, especially in the case of repeat checks. This includes measurements of the drop time of absorber rods or the confirmation of successful coupling of the sodium orifice adjustment devices in the area of the coolant inlet below the core. The ultrasonic methods developed and tested at Karlsruhe are described. (auth)

13234 DETECTION OF PACKETS WITH NON-HERMETIC FUEL ELEMENTS ON SODIUM-COOLED FAST REACTORS. Aristarkhov, N. N.; Bets, N. I.; Efimov, I. A.; Filonov, V. S.; Kevrolev, V. P.; Rybakiv, V. N.; Skvortsov, S. A. pp 515-523 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Tests have been carried out on the sodium test rig into the nature of leakage of radioactive inert gases from packets with non-hermetic fuel elements and the behaviour of the gases in liquid sodium. Various methods have been developed for testing the packets without removal from the active zone in regard to sodium-cooled fast reactors. Tests on the BR 5 reactor indicated that the test arrangement developed detects packets with non-hermetic fuel elements to a probability of greater than 90%, the time taken for checking one packet being approximately one hour. On the BOR 60 reactor, the arrangement detects packets with non-hermetic fuel elements to 100% probability, and occupying approximately twenty

minutes for each packet. The mean ratio of instrument readings in the checking of packets with non-hermetic and hermetic fuel elements was 6 to 9 for the BR 5 reactor and over 100 for the BOR 60 reactor. The high safety level of the equipment for the reactor and servicing personnel has been confirmed. (auth)

13235 SPECIAL INSTRUMENTATION FOR PHENIX. Lions, N. (CEN de Cadarache, Saint-Paul-les-Durance, France); Cambillard, E.; Pages, J. P.; Chantot, M.; Buis, H.; Baron, J.; Langlois, G.; Lannou, L.; Viala, M. pp 525-535 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Special instrumentation for Phenix, and the tests and operation results of the instruments, are described: (I) ultrasonic visualization in sodium system (VISUS) – to provide a visual display of objects in a reactor vessel, particularly of the heads of fuel assemblies and handling devices immersed in sodium; (II) failed fuel detection and location–instrumentation; (III) hydrogen detection. (UK)

13236 DEVELOPING AND TESTING OF THE REFUELLING SYSTEM MECHANISMS ON THE BN 350 REACTOR. Kurilkin, V. V.; Mitenkov, F. M.; Shiryaev, V. I.; Shapkin, A. F. pp 541-544 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A description is given of the stages of development in the construction of the BN 350 reactor refuelling system mechanisms on the control assembly rig "cold" and "hot" tests of the overall refuelling mechanisms prior to reactor startup. (auth)

13237 DESIGN AND RESEARCH AND DEVELOPMENT PROGRAMME OF THE PEC CORE RELATED MECHANISMS. Basile, F. (CNEN, Bologna); Gerosa, A.; Mennucci, M. pp 555-576 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A description is presented of the core-related mechanisms of the PEC, with particular regard to the control rod mechanism, the core hold-down device and the refuelling machine whose prototypes are being constructed. A summary is given of the tests performed on critical components, and the program for integral testing of the full-scale prototypes is presented. The description of the IPM test facility for testing in sodium the prototypes of the above core-related mechanisms, erected and tested in 1973, is also given. (auth)

13238 FUEL AND SPECIAL HANDLING OF PHENIX REACTOR. Preliminary and Operational Tests. Benoist, E. (CEN de Cadarache, Saint-Paul-les-Durance, France); Merland, D.; Michot, G.; Boulinier, C.; Mulot, P. pp 577-584 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Tests carried out with fuel assemblies handling installations as well as special handling installations were effectuated without major incident in air and in sodium after reactor and storage drum filling. These satisfactory results are due to many tests carried out in air and even in sodium, before any operation on reactor. In particular, for machines for the assemblies handling line, new installations such as transfer arm and charging lock have been built as full scale prototypes and tested in sodium in normal operation conditions. The handling equipment is fully described, together with the tests. (auth)

13239 FUEL HANDLING AND OTHER IN-REACTOR MECHANISMS IN PFR. Hunt, C. R. (Nuclear Power Groups Ltd., Risley, Eng.); Riley, P. L.; Campbell, N. pp 585-595 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The on-site testing and commissioning of the PFR in-reactor mechanisms is described. The various mechanisms which are installed in PFR are outlined and a calendar of events and a description of the various difficulties which have arisen during the on-site testing are presented. (auth)

13240 REACTOR AND FUEL HANDLING ON PNC PROTOTYPE FAST BREEDER REACTOR PLANT MONJU. Nakai, Y.; Kitagawa, H.; Watanabe, T.; Saito, S.; Yamagishi, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 597-599 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The design of the "MONJU" prototype fast reactor succeeding the "JOYO" experimental fast reactor is carried out by P. N. C. The "MONJU" plant uses a loop type configuration for the primary system and a single rotating plug-fixed arm pantograph type fuel handling mechanism for refueling system. The design and major R & D works are discussed. (auth)

13241 FUTURE PROGRAMMES AND PLANES FOR PROTOTYPE AND PROSPECTS FOR CFRs. Carle, R.; Megy, J.; Leduc, J.; Villeneuve, J. pp 605-609 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

First the importance of the assistance of R and D organizations toward the development of commercial nuclear power plants is examined; then the main options selected for SUPER-PHENIX are explained; lastly some views on the economic potential of fast nuclear plants are discussed. (auth)

13242 U. S. FAST BREEDER REACTOR DEVELOPMENT PROGRAMME. Nemzek, T. (Argonne National Lab., IL); Laney, R.; Squire, A.; Iacobellis, S.; Wolfe, B.; Landis, J.; Taylor, J. pp 611-619 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The fast breeder reactor is a major element in approaches to resolving the energy problems increasingly confronting the major industrial nations. The United States has accorded the Liquid Metal Fast Breeder Reactor the highest priority effort in its advanced reactor development program but is also providing significant support to the Light Water Breeder Reactor, the Gas-cooled Fast Breeder Reactor, and the Molten Salt Breeder Reactor as alternative options. The efforts of the USAEC, national laboratories, industrial contractors, and the nuclear industry including the electric utilities, are combined in the LMFBR program and are essential for its success. Commerical introduction of the breeder will be dependent on utility acceptance of the breeder and participation of the utilities in its development. (auth)

13243 CHALLENGING PROBLEMS FACING THE ARCHITECT-ENGINEER ON THE UNITED STATES LIQUID METAL FAST BREEDER REACTOR DEMONSTRATION PROJECT. Roe, K. A. (Burns and Roe, Inc., Oradell, NJ). pp 621-626 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The United States Atomic Energy Commission has established the Liquid Metal Fast Breeder Reactor (LMFBR) as the highest priority program to exploit the energy resources of uranium in the 1980's. In order to achieve this objective the LMFBR Demonstration Plant must be designed and in operation by 1980. The scheduled operating date for the LMFBR Demonstration Plant means there is less time for design and construction of a commercial nuclear power plant. This target offers quite a challenge to the architect-engineer. The design of the Demonstration Plant will incorporate the proven technology for liquid metal systems from the Fast Flux Test Facility and will utilize to the greatest extent possible established standards so that commercial fast breeders can be built from the know-how established in the Demonstration Plant. The engineering of this plant will be pioneering new approaches in the area of safety philosophy as well as in the development of designs which will assure a higher degree of reliability, availability and maintainability than present commercial plants. The organization and the techniques developed by the engineers to meet the many challenging problems of this program are described. (auth)

13244 FUTURE OF FAST REACTORS IN ITALY. Fogagnolo, G. (NIRA, Genoa); Pierantoni, F. pp 627-630 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

An outline is presented of the plans for fast reactors in the Italian reactor program. The ultimate aim is to integrate the Italian program into a larger bilateral or multinational one. Available effort has therefore been concentrated on areas of highest technological content specific to breeders, such as fuel and sodium components. Only the sodium coolant line was followed. Research programs so far conducted in CNEN and in Italian industry are discussed in relation to future needs and possibilities. (UK)

13245 SODIUM-COOLED FAST REACTORS. An electricity Utility's Perspective. Carpenter, E. W.; Harrison, J. R.; Kemmish, W. B. (Central Electricity Generating Board, London). pp 631-636 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

In developing commercially viable sodium-cooled fast reactors, great emphasis must be placed on achieving safe and reliable performance of components. The high cost of loss of availability is the most relevant economic factor. The development programme must include full-scale component testing, and the design must include margins against errors in extrapolating from the limited experience which is available. Extensive inspection, maintenance and repair facilities will be required. (auth)

13246 UK FAST REACTOR DEVELOPMENT AFTER PFR. Macrae, W. (Nuclear Power Group Ltd., Risley, Eng.); Moore, J. pp 637-647 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

With the commissioning of PFR the UK effort on fast reactors is becoming increasingly directed to the particular requirements of full-scale commercial power stations. The requirements of such stations were studied jointly by the UK electricity boards, the UKAEA and the British nuclear industry, as a basis for the PFR design and this close liaison between the parties on CFR development requirements has continued since. The design of CFR 1 has reached the stage where the requirements of the development program, particularly that for major components, can be defined and the necessary work initiated. As a beneficial result of the close liaison with the UK electricity boards, considerable emphasis is being placed on the achievement of good reliability and ease of maintenance. Where experience with PFR has shown changes to design to be desirable these are being introduced. The UK's program of CFR development work is being conducted in accordance with a plan in which the construction of a lead station, CFR 1, would be started after two to three years operation of PFR. This plan is fully integrated so as to achieve maximum efficiency and coordination of the numerous inter-linked activities. As in other countries, the key areas of this development work are those of component development and safety studies. New large test and demonstration facilities are being built for this purpose. Attention is being given to all aspects of the fuel cycle, including fuel fabrication, reprocessing and transport. The general consensus among various countries on the potential advantages of the fast reactor system and the fact that many, like the UK, are reaching the stage of considering full-scale demonstration plants opens the way for fruitful international collaboration and liaison, by sharing the benefits of operational experience and the costly development work necessary in this field. (auth)

13247 PLANS FOR SNR 2. Traube, K. (INTERATOM, Bensberg, Ger.). pp 649-655 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

SNR 2 is to be constructed as a demonstration plant following completion of SNR 300, by the Debenelux industry for an international utility association of RWE, EdF and ENEL, the same association that will order SUPERPHENIX. Although construction start will be in 1980 planning began in 1972 at Interatom. Organization, time schedule, design guides and preliminary design features are discussed. (auth)

13248 PANEL DISCUSSION ON THE STATE OF THE ART ON THE INTRODUCTION OF FAST REACTOR POWER STATIONS INTO A GENERATING NETWORK. Hafele, W.; Campbell, R. H.; Traube, K. pp 663-668 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The panel discussion included the following topics: the successful completion of BN 350, PFR and PHENIX and plans for commercial fast reactors; the ability of commercial FBR's to meet the needs of the electricity supply utilities (response to load changes, availability, etc.); cost, economics, size, efficiency and reliability; burnup, breeding ratio and doubling time; fuel cycle and uranium supply; failed element detection and reactor safety; steam generators. (UK)

13249 PHENIX START-UP, AN IMPORTANT EVENT IN WESTERN EUROPE. Bellou, A. Energies; No. 908, 4-5(21 Sep 1973). (In French).

A brief review is given of the characteristics of the Phenix reactor. The important role envisaged for this type of reactor in the production of electrical energy is discussed. (FR)

13250 EXPERIMENT FOR NEUTRON TRANSPORT THROUGH STRAIGHT SODIUM PIPES. Burian, J. (Inst. of Nuclear Research, Rez, Czech.); Jansky, B.; Oshmera, B.; Otopal, P.; Petrov, E.; Trikov, L.; Nikolaev, A.; Semenov, V. (Inst. of Nuclear Research, Rez, Czech.). Jad. Energ.; 20: No. 11, 362-366(Nov 1974). (In Russian).

The description of an experiment to determine the streaming effect of neutrons through straight sodium pipes of fast reactor is presented. The results are included. Neutron spectral measurements were taken using the following types of spectrometers: stilbene scintillator, proportional hydrogen counter, multispheres and activation foils. (auth)

13251 STATUS REPORT ON THE FAST BREEDER PROJECT 1974. Development of the SNR Line. Hueper, R. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter). At. Strom; 20: No. 7/8, 88-90(Jul 1974). (In German).

Progress has been made since the spring of 1973 in the construction of the Kalkar (SNR 300) nuclear power station, and the compact sodium-cooled nuclear station (KNK) has gone up to full power. The nuclear research centers at Karlsruhe, Mol/Belgium, Petten, and Appeldoorn/Holland are working on the joint fast breeder project, mainly in the fields of fuel-rod and materials development, physics, and safety. The various research and development projects are discussed. (auth)

13252 LMFBR: THE ONLY ANSWER. Baron, S. (Burns and Roe, Inc., Oradell, NJ). Mech. Eng.; 96: No. 12, 12-20(Dec 1974).

An evaluation of the energy resources and energy consumption demands in the U. S. is presented. A comparison of resources in meeting the energy demands is analyzed. Various parameters used in the comparison include: abundance of resource, efficiency of energy conversion, effects on the environment, economics, and development technology. (DCC)

13253 NUCLEAR REACTOR WITH INTEGRATED HEAT EXCHANGER. Ventre, E. US Patent 3,847,733. 12 Nov 1974. Priority Date 5 Aug 1970, France. 6p.

The reactor comprises within a leak-tight vessel a number of reactor cores disposed in a circle on a supporting platform, a fuel-handling device mounted above one of the cores, a heat-exchanger suspended above each of the remaining cores, a central column rigidly fixed to the core-supporting platform and extending through the entire reactor vessel. The central column is coupled at a point located outside the reactor vessel to a system for carrying out the rotary displacement of the column about its own axis and thus causing the rotary displacement of the reactor cores so as to bring each core in turn from the normal operating position beneath a heat-exchanger to the refuelling position beneath the fuel-handling device. (Official Gazette)

13254 METHOD OF DISTINGUISHING BETWEEN FUEL AND/OR BREEDER ELEMENTS INTENDED FOR OR INSERTED IN A NUCLEAR REACTOR. Overhoff, T.; Stupp, H. J. (to Kernforschungsanlage Julich Gesellschaft mit beschrankter Haftung). US Patent 3,841,757. 15 Oct 1974. Priority Date 26 Nov 1971, F. R. Germany. 6p.

A method is described for distinguishing between fuel and/or breeder elements intended for or inserted in a nuclear reactor, the fuel and/or breeder materials being contained in a graphite covering or matrix. Before the fuel and/or breeder elements are introduced into the reactor, chemical substances are added to the carbon of the covering or matrix. After oxidizing, these chemical substances are slightly diffusible and at most negligibly affect the neutron flow of the reactor; their spectral lines are undisturbed by the carbon bands and are capable of being excited by a laser pulse. The chemical substances are introduced into the graphite of the covering or matrix at such a concentration, that the macroscopic neutron absorption cross section remains small. The fuel and/or breeder elements are irradiated by laser pulses in such a way, that the plasma focus formed thereby is located in the optical beam path of a device known per se and suitable for spectrum analysis. (Official Gazette)

13255 STACKED AND TILTABLE COMPARTMENTS FORMING A NUCLEAR FUEL ASSEMBLY. Class, G.; Eggers, B. (to Gesellschaft fuer Kernforschung). US Patent 3,846,234. 5 Nov 1974. Priority Date 20 Mar 1970, F. R. Germany. 6p.

A fuel element box of the type associated with a reactor is formed of a plurality of compartments arranged in an axial series and held together by tension members. The connection between each compartment allows for a displacement of one compartment relative to an adjoining compartment. (Official Gazette)

13256 FUEL STACK DIMENSIONAL VARIATIONS IN FAST REACTOR PINS UNDER IRRADIATION. Calza-Bini, A.; Cosoli, G.; Filacchioni, G.; Lanchi, M.; Nobili, A.; Pesce, E.; Rocca, U.; Rotoloni, P. L. (CNEN, Rome). Nucl. Technol.; 25: No. 1, 92-102(Jan 1975).

Irradiation experiments were carried out by the Comitato Nazionale Energia Nucleare to evaluate the mechanical prop-

erties of the fuel pin for fast reactors. The fuel pins were placed in-pile in an irradiation device specially equipped for the continuous measurement of the fuel dimensional variations by means of a resonant cavity system; total power and cladding temperatures were also measured. The data consist mainly of the measurement of the axial gap variations versus linear heat rating and burnup for the three types of fuel under study: pellets, cored pellets, and vibro-compacted sol-gel. The important movements in the fuel column and the different behavior of the three types of fuel tested were observed. (auth)

13257 RATE OF LIQUID ENTRAINMENT AT THE GAS-LIQUID INTERFACE OF A LIQUID SUBMERGED SONIC GAS JET. Chawla T. C. (Argonne National Lab., IL). Nucl. Sci. Eng.; 56: No. 1, 1-6(Jan 1975).

A model is presented describing the phenomenon of liquid entrainment resulting from the presence of Kelvin-Helmholtz instability at the gas-liquid interface of a sonic gas jet submerged in a mass of liquid. On the basis of this model, available experimental data regarding the rate of entrainment were correlated satisfactorily. The correlation thus obtained is of importance in deriving the heat transfer coefficient in the impingement area of a fuel pin impinged upon by a fission-gas jet released from a failed pin in a liquid-metal-cooled fast breeder reactor fuel subassembly. (auth)

13258 DEMOUNTABLE GRID FOR THE SUPPORT OF FUEL ASSEMBLIES IN A NUCLEAR REACTOR. Aubert, M.; Berniolles, J. M.; Bellier, M. (to Societe Creusot-Loire). French Patent 2,168,200/A/. 20 Jan 1972. 11p. (In French).

The grid forms a one-piece assembly resting on an inner shoulder provided in the lower portion of an upright vessel. This one-piece assembly comprises two horizontal parallel support plates which are integral with an annular distribution casing and are linked by vertical hollow sleeves into which are inserted the lower portions of the fuel assemblies to be supported. (FR)

13259 FAST REACTOR PROGRAM. Srinivasan, N. (Reactor Research Centre, Kalpakkam, India). pp 143-163 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

The 15 MW(e) KALPAKKAM LMFBR, which is under construction, will provide experience in construction and operation of a sodium cooled fast reactor. Fuel and material testing is an essential aspect of fast reactor development. The reactor will serve as an irradiation facility, and radiometallurgical and radiochemical laboratories will provide the necessary support. A significant effort in material science is also planned. A pulsed fast reactor is also planned for construction and will be a valuable tool for studies in radiation damage and solid state physics. The success of fast breeders is significantly dependent on efficient methods of reprocessing irradiated fuel. Development work in reprocessing fast reactor fuels is included in the program of the Reactor Research Center. An extensive program in sodium technology, reactor component development and testing, and fast reactor instrumentation is also planned. Establishment of fuel fabrication technology will be undertaken at Trombay. The LMFBR reactor and the various laboratories will be in operation by 1976-77. The design of a prototype fast breeder will commence in 1974 to permit construction by the end of the decade. (auth)

13260 THERMOELECTRIC DEVICE FOR MEASURING THE TEMPERATURE OF A LIQUID METAL COOLING A NUCLEAR REACTOR. Cambillard, E.; Huetz, J. (to Commissariat a l'Energie Nuclear). French Patent 2,176,522/A/. 22 Mar 1972. 10p. (In French).

The device comprises a plurality of metal sensors, immersed in the liquid metal at the various points the temperature of which is to be measured and a reference sensor similar to the above sensors but immersed in an isothermal zone of the liquid metal. The electric readings provided by the various thermocouples formed by the metals of the respective sensors and by the liquid metal are carried outside the reactor by means of wires of the same metal and are compared one after the other to the reference sensor readings. This device can be applied to nuclear reactors particularly the fast neutron type. (FR)

13261 PROBLEMS OF PREPARING COOLANTS FOR FAST REACTORS. Karpov, A. V.; Archipov, V. M.; Matveev, V. P.; Baklushin, R. P. (Physical Energy Inst., Obninsk, USSR). Kernenergie; 17: No. 9, 289-292(Sep 1974). (In German).

The methods of preparing coolants for fast reactors are considered. Features of the preliminary purification systems of the BR-5, BOR-60, and BN-350 reactors are discussed. Contents of impurities in the sodium prepared for being filled into the coolant loops are given. Requirements made on the coolant preparation systems of fast power reactors are derived. 3 references. (auth)

13262 STUDY OF THE SPATIAL DISTRIBUTION OF ENERGY RELEASE OVER THE BOR-60 REACTOR CORE. Gryazev, V. M.; Inchagov, A. V.; Lestchenko, Yu. I.; Nigmatullin, N. R.; Fofanov, V. S.; Khilenko, S. N. (Forschungsinstitut fuer Kernreaktoren, Dimitrovgrad, USSR). Kernenergie; 17: No. 9, 284-289(Sep 1974). (In German).

The results of measurements of the spatial distribution of energy release over the BOR-60 reactor core are reported. The indicators and measuring conditions used are analyzed and the inhomogeneity coefficients K_r and $K_z = K_z(r)$ of energy release over the reactor core are determined. The absolute reaction rates for ^{235}U and ^{238}U fission and ^{238}U neutron capture as well as the spectral indices (ratio of fission and capture cross sections averaged in the measuring point over the spectrum) in the core center are given. Experimental and theoretical values for the BOR-60 reactor are compared with each other. Moreover, data for the fast assembly "Fortissimo" are reproduced, the spectrum of which is near that of the BOR-60 reactor. 5 references. (auth)

Research, Test, and Experimental Reactors

Refer also to abstracts 10601, 10602, 11328, 12161, 13126, 13167, 13330, 13386, 13387, 13390, 13391, 13399, and 13428.

13263 (HEDL-TME-74-52) THREE-DIMENSIONAL NEUTRONICS CALCULATIONS OF FTR SAFETY PARAMETERS. Nelson, J. V.; Hardie, R. W.; O'dell, L. D. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Aug 1974. Contract AT(45-1)-2170. 188p. AT.

Parameters required for Fast Test Reactor (FTR) safety analysis have been calculated using a detailed three-dimensional full core model of the FTR and a twelve group cross section set. The spatially dependent parameters include sodium, fuel, and stainless steel reactivity coefficients, plus Doppler weighting functions and power and total flux distributions. Axial traverses of these data are plotted by subassembly for three core configurations: beginning of life, beginning of cycle 4, and end of cycle 4. Power peaking factors, power generation by subassembly, and the percentage of flux greater than 0.11 MeV are also tabulated. Results of a comparison between twelve- and thirty-group calculations of sodium void worths are presented. (auth)

13264 (INIS-mf-1478) FAST IRRADIATION AND ACTIVATION ANALYSIS SYSTEM; PROVISIONAL OPERATING DESCRIPTION. Partridge, C. A. 9 Apr 1974. 15p. INIS.

A provisional description is given to assist in evaluation of the safety aspects of the system prior to the completion of the apparatus or production of full working manuals. The system is a means of despatching samples, contained in rabbits, into the neutron flux of a reactor and then retrieving them rapidly for immediate or delayed gamma or neutron activation analysis. The propulsion inside the reactor is by means of suction drive (vacuum) and that outside by means of compressed air. (INIS)

13265 (JUL-Conf-10, pp 258-285) IRRADIATION PROGRAMME FOR THE DEVELOPMENT OF REACTOR MATERIALS USING IN-PILE TEST FACILITIES AT TROMBAY. Mehta, S. K.; Sarda, V.; Menezes, P. F. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

The Department of Atomic Energy of India has a program for initially building a series of PHWR type reactors. A description is given of the irradiation facilities at Bhabha Atomic Research Centre and their utilization for engineering studies in support of the overall power reactor program, particularly for the development of reactor fuels. (auth)

13266 (JUL-Conf-10, pp 307-333) REACTOR IRRADIATION EXPERIMENTS AT JUELICH. Hasenclever, B. (Kernforschungsanlage, Juelich, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

A description is given of irradiation work at Jülich together with technical details of the irradiation installations and related dosimetry problems. (auth)

13267 (JUL-Conf-10, pp 334-364) DEVELOPMENT AND CONSTRUCTION OF IRRADIATION FACILITIES FOR THE INVESTIGATION OF FUEL ELEMENTS AND STRUCTURAL MATERIALS. Lehrheuer, W. (Kernforschungsanlage, Juelich, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Economic and technical considerations in designing and constructing irradiation facilities are examined. Irradiation rigs in use at the FRJ-2 reactor are described. (DG)

13268 (JUL-Conf-10, pp 430-435) PHYSICS CONSIDERATIONS OF DESIGNING LOOPS FOR FUEL IRRADIATION. Rastogi, B. P.; Nakra, A. N.; Balakrishnan, K. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Conceptual design of a PHWR type reactor for fuel irradiation testing is in progress at Trombay. The constraints of 100 MW thermal rating, aluminum cladding, and reactivity requirements have limited the attainable neutron flux. Calculations have been made to estimate the specific power experienced by the test bundle (a 28 rod cluster used in 500 MW(e) PHWR type reactors) in the central loop position with various plutonium enrichments. The increase in the specific power by enrichment leads to an increase in the thermal gradient in the test bundle. A question on the suitability of irradiation experiments for fuel development programs is posed. (auth)

13269 CONTRIBUTIONS OF THE FERMI 1 PROJECT TO FAST BREEDER REACTOR TECHNOLOGY. Alexanderson, E. L. (Power Reactor Development Co., Detroit). pp 13-19 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Experience with the Enrico Fermi I project not previously reported is discussed. The following topics are discussed: sodium cleanup experience; reactor coolant outlet temperature response; temperature fluctuations during steady-state operation; coolant mixing in reactor high-pressure inlet plenum; reactor power calibration results; fuel performance; fuel assembly stress relaxation; decommissioning experience. (UK)

13270 EBR-2 SUPPORT OF BREEDER DEVELOPMENT. Evans, E. A. (Hanford Engineering Development Lab., Richland, WA); Kyger, J. A.; Loewenstein, W. B. pp 63-70 of Fast Reactor Power Stations. b. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A brief description is given of EBR-II and some statistics of its use as a test facility, especially for LMFBR oxide fuels and structural materials. An account is given of two recent additions to the in-core facilities (the Instrument Subassembly Facility (INSAT) and the In-core Instrument Test Facility (INCOT) and two out-of-core facilities (the Nuclear Instrument Test Facility (NITF) and the Radioactive Sodium Chemistry Loop (RSCL)). Operating experience with EBR-II is discussed. (UK)

13271 FAST FLUX TEST FACILITY. Nolan, J. E.; Morabito, J. J.; Simons, A. A.; Cockeram, D. J. pp 71-84 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The Fast Flux Test Facility (FFTF) is the primary test facility for the Liquid Metal Fast Breeder Reactor (LMFBR) program in the United States. To accomplish its goal, this test reactor plant is capable of carrying out the fuels and materials testing programs required, to develop and demonstrate economical fuels, and to provide proof testing of materials for use in the LMFBR program. (auth)

13272 OPERATING EXPERIENCE WITH THE KNK REACTOR AND PREPARATIONS FOR A FAST MIXED OXIDE CORE (KNK 2). Brudermuller, G. (Kernkraftwerk-Betriebsgesellschaft m.b.H., Leopoldshafen, Ger.); Finke, G.; Guthmann, E.; Hendl, G.; Marth, W. pp 111-118 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The experimental sodium cooled power station KNK at Karlsruhe is being operated at 100% power until the second half of this year, when it will be equipped with a second fast core KNK II. Problems with sodium frost deposits in the gaps of the rotating top shield system and of the second shut down rods were corrected by raising the temperatures in the rotating top shield. Radiation resistant grease showed insufficient lifetime under certain mechanical loads in the main valve drives. An intermediate size leak in the steam generator caused a Na/H_2O reaction, which was not strong enough to break the rupture discs. A transient partial blockage of one fuel element remains unexplained. (auth)

13273 PEC REACTOR. Aiello, P. (CNEN, Bologna); Cicognani, G.; Ciriegi, U.; Zona, R. pp 119-122 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

A description is given of the reactor and of the plans for using it as a fast flux test reactor in the Italian fast reactor program. It is stated that the broad aims of the reactor are: to test the fuel elements of future fast breeder power plants as close as possible to their nominal operating conditions; to ascertain their safety margins by extending the test beyond the normal operating conditions; to obtain direct information on the behavior and condition of the fuel during and after irradiation. (UK)

13274 EXPERIENCE WITH HANDLING CORE SUBASSEMBLIES IN SODIUM-COOLED REACTOR KNK AND TEST RIGS. Althaus, D.; Jansing, W.; Kesseler, R.; Kirchner, G.; Menck, J. (INTERATOM, Bensberg, Ger.). pp 545-554 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

Compared with a water-cooled reactor plant, a sodium-cooled reactor plant presents a number of problems which result from the specific nature of sodium. These problems that must be faced during all handling operations are mainly: (1) the rapid reaction of sodium in the presence of air requires that the handling be done only under cover gas; (2) the temperature of all sodium-wetted components is to be kept above the melting point of sodium; (3) poor draining of removed reactor components due to the high surface tension of sodium and, with this, the associated danger of dripping radioactive sodium may produce a high radiation or contamination problem; and (4) sodium is not transparent. The sum of these and further influences dictate that the general handling usually is carried out without visual means, though a method is under development in the USA to use ultrasonic for under sodium "viewing". These limitations to sodium component handling are applicable to all sodium reactor plants, several of which are discussed. First the handling systems of the KNK-plant now operating at Karlsruhe are described. Following that is an account of the experience of the SNR test rig and finally the paper describes the handling systems for the SNR 300 and the SNR 2000. (auth)

13275 STUDIES OF THE EVEN-EVEN NUCLEI WITH ON-LINE IRRADIATION APPARATUS AND SEMICONDUCTOR DETECTORS. Okano, K. (Kyoto Univ.). pp 123-134 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

For the detailed study of short-lived activities produced by (n,γ) reactions with a Ge(Li) γ-ray spectrometer, a special pneumatic irradiation apparatus with on-line measurement system has been designed and installed at the through-tube facility of the Kyoto University reactor. With this apparatus the irradiation of a sample and the subsequent nuclear spectroscopic measurements are automatically and cyclically performed. With this apparatus, singles and coincidence spectra of γ rays and angular correlations of cascading transitions have been measured for several short-lived isotopes. An automatic sample changer has also been installed in order to avoid the accumulation of longer-lived activities. The description of these apparatus and some of the results obtained so far are described. (auth)

13276 TRIGA OWNERS' CONFERENCE III, ALBUQUERQUE, NEW MEXICO, FEBRUARY 25-27, 1974. Papers and Abstracts. San Diego, CA; General Atomic Company (1974). vp. (CONF-740206-).

Thirty-one of the thirty-six papers presented at the conference are reproduced together with abstracts. Topics of the papers include reactor operation, analytical and experimental methods, utilization programs, reactor kinetics, reactor effluents, reactor modifications, and effluent standards. The thirty-one papers were separately indexed for NSA. (DG)

For abstracts of individual papers see: 12161, 13277-13303, 13330, 13391, and 13428.

13277 OPERATION EXPERIENCE AT THE NEUHERBERG, RESEARCH REACTOR (FRN) WITH SEVERAL MODIFICATIONS OF REACTOR COMPONENTS. Demmeler, M.; Rau, G. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Neuherberg. pp 1.1-1.20 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Since the first full power operation in September 1972 the TRIGA Mark III reactor FRN has run more than 500 MWh in steady state operation and has been pulsed 265 times. During startup experiments, neutron- and gamma-flux mapping has been performed with special instrumentation in the core and in several irradiation positions, mainly in the thermal column and in the exposure room. Reactivity values of each fuel element have been measured at full power of 1 MW, thus permitting a more accurate burnup calcula-

tion. Troubles with the rotary specimen rack occurred at power rates above 280 kW; the lazy susan stuck as a result of thermal stress. It will be replaced by a hydraulic-operated type which has been developed at the TRIGA Heidelberg reactor. In order to increase irradiation capacity, a new core configuration was achieved through replacing several fuel-reflector elements by irradiation tubes within the grid-plate positions E-22, G-2, G-17 and G-36. Four additional fuel elements had to be inserted to compensate for the resulting reactivity losses. The original plan of regaining sufficient excess-reactivity by inserting a fuel element in grid-plate position A-1 failed because of local boiling in the center of the core at 1 MW-operation. Experiments at the reactor started with the beginning of routine-operation in September 1973. A total of 450 neutron- and gamma-irradiations have been performed, mainly for neutron-activation studies. (auth)

13278 OPERATIONAL EXPERIENCE AT THE AFRRI–TRIGA REACTOR FACILITY (1972–1974). McKenzie, J. L. (Armed Forces Radiobiology Research Inst., Bethesda, MD). pp 1.21-1.47 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The AFRRI reactor experienced three operational incidents during the period from February 1972 to February 1974. The first incident consisted of a failure of a weld at the top of the tri-flute on an instrumented fuel element which allowed the tri-flute to move up about one-half inch from its normal position. The instrumented fuel element was removed from the reactor core and replaced with a new instrumented fuel element. The second incident consisted of a malfunction of the reactor core position safety interlock which resulted in the lead shield doors closing around the reactor core shroud. The lead shield doors did not make contact with the reactor core shroud and therefore no damage occurred. The third incident consisted of a failure of the threaded connector on the top of the transient control rod which allowed the transient control rod to separate from the connecting rod and drop to the bottom of the guide tube. The damaged transient control rod was removed from the guide tube and a new transient rod was installed in the reactor core. The second and third incidents were reported to the Atomic Energy Commission. A modification of Exposure Room No. 2 consisted of placing panels painted with gadolinium oxide paint on the walls, ceiling, and reactor core tank projection. This resulted in the ^{41}Ar production rate and the effluent release to the environment being reduced by a factor of 10 to 20, depending upon the position of the reactor core. (auth)

13279 SPARE-PARTS INVENTORY PROGRAM FOR TRIGA REACTORS. Anderson, T. V.; Ringle, J. C.; Johnson, A. G. (Oregon State Univ., Corvallis). pp 1.48-1.53 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

When the OSU TRIGA first went critical in March of 1967, a few spare parts were on hand as part of the original purchase. Within a year or so, however, it became apparent that a spare parts inventory should be maintained in order to avoid unnecessary or prolonged outages due to the lack of a crucial piece of equipment. Many critical components (those which must be present and operable according to licensing or technical specifications) were considered, and a priority list for acquiring these was established. This first list was drawn up in March, 1969, two years after initial criticality, and some key components were ordered. The availability of funds was the overriding restriction then and now. This spare-parts list is reviewed and new components purchased annually; the average amount spent has been about $2,000 per year. This inventory has proved invaluable more than once; without it, lengthy shutdowns would have occurred while awaiting the arrival of the needed component. A suggestion is offered to either (a) encourage General Atomic, through the collective voice of all TRIGA owners, to maintain a rather complete inventory of replacement parts, or (b) maintain an owner's spare-parts pool, financed by contributions from all the facilities. If either of these pools were established, the needed part could reach any facility within the U. S. within a few days, minimizing reactor outage time. (auth)

13280 DETECTION OF A LEAKING BORON-CARBIDE CONTROL ROD IN TRIGA MARK I REACTOR. Blotcky, A. J.; Arsenault, L. J. pp 1.54-1.57 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

During a routine quarterly inspection of the boron-carbide control rods of the Omaha Veterans Administration Hospital 18 kW TRIGA Mark I reactor, a pin hole leak was detected approximately 3 mm from the chamfered edge. The leak was found by observing bubbles when the rod was withdrawn from the reactor tank for visual observation, and could not be seen with the naked eye. This suggests that pin hole leaks could occur and not be visually detected in control rods and fuel elements examined underwater. A review of the rod calibrations showed that the leak had not caused a loss in rod worth. (auth)

13281 LOW FLUID LEVEL IN PULSE ROD SHOCK ABSORBER. Aderhold, H. C. (Univ., Ithaca, NY). pp 1.58-1.67 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

On various occasions during pulse mode operation the shim and regulating control rods would drop when the pulse rod was withdrawn. Subsequent investigation traced the problem to the pulse rod shock absorber which was found to be low in hydraulic fluid. The results of the investigation, the corrective action taken, and a method for measuring the shock absorber fluid level are presented. (auth)

13282 BINDING IN THE LAZY SUSAN OF THE 1 MW TRIGA AT THE CENTRO NUCLEAR DE MEXICO. Sanchez, J.; Mulas, P.; Mariano, G.; Hernandez, R. (Instituto Nacional de Energia Nuclear, Mexico City). pp 1.68-1.71 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Because of problems with the original Lazy Susan, a new Lazy Susan was supplied by the fabricant, and it was judged convenient to perform an out-of-core test of the replacement. A rig was built to produce temperature gradients similar to the ones encountered in the operation at high power levels. After a temperature difference (estimated between 130°C and 170°C) between the rotating part and the outside surface was established, the Lazy Susan started to bind. This was reported to the fabricant and it was concluded that a new design was needed. Since it would take at least two years before the new unit could be acquired, it was decided to install the Lazy Susan recently supplied. The unit now rotates for approximately 20 minutes when the reactor is operating at 1 MW and then binds. At lower power levels it is operative for longer periods of time. (auth)

13283 MEASUREMENT OF ARGON CONCENTRATIONS IN A TRIGA MARK-III POOL. Simms, R. (California State Univ., Northridge). pp 1.75-1.85 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Argon-41, the principal radioactive effluent from a pool type reactor during normal operation, is produced by the ^{40}A(n,γ) reaction. The reactant, ^{40}A, is introduced into the pool water by contact with the air. Reduction in radioactive argon release can be accomplished by reducing the concentration of dissolved ^{40}A and retaining the ^{41}A within the pool. However, little data were available concerning the mechanisms of argon introduction, production, retention, and release from a reactor pool. Experiments have therefore been performed at the Torrey Pines TRIGA Mark-III Reactor to develop techniques to sample dissolved argon and to provide data on argon concentrations in the pool for release modeling studies. Significant results for argon dissolved at different pool depths can only be obtained if the water samples are sealed at the point of collection. A special handling tool was developed to perform this remote operation. Pool samples were counted for ^{41}A soon after collection with a NaI spectrometer. After allowing one day for decay of ^{41}A, the concentration of ^{40}A in the water sample was determined by neutron activation analysis. In each case, the 1.29 MeV gamma-ray peak of ^{41}A was used. Interference from the 1.37 MeV ^{24}Na peak was considered and its effect subtracted after determining ^{24}Na content from the 2.75 MeV ^{24}Na peak and a sodium standard. A Ge(Li) detector was tried and found to eliminate the problem, but it introduced an unacceptable geometrical effect dependent on bubble size within the sample bottles. Samples were taken from the 27 ft deep TRIGA pool at various locations. Results were obtained for samples taken on several different days along the same vertical line about 3½ ft from the reactor centerline. Temperature measurements along this vertical traverse indicated a sharp temperature gradient at about 15 ft below the surface (~6 ft above the top of the reactor). The ^{40}A concentration increases slightly below this point, but the distribution is relatively more uniform throughout the pool than assumed by the usual argon release model. The ^{41}A count rate distribution, a relative measure, suggests that the dissolved ^{41}A distribution is also relatively uniform throughout the pool, an apparent consequence of the recirculation rate provided by the pool cooling system. Although unsubstantiated, reductions in ^{40}A concentration

might be achieved by redesign of the pool skimmer and the diffuser pump to reduce air input into the lower pool region. (auth)

13284 EXPERIMENTS UTILIZING TWO COUPLED TRIGA-TYPE REACTORS. Thayer, G.; Jones, B. G.; Miley, G. H. (Univ. of Illinois, Urbana). pp 2.1-2.23 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

An experimental study has been performed on a coupled-core system consisting of two reactors each of which can be made critical by itself, coupled neutronically by a graphite thermal column. Both steady-state and transient measurements were performed on the system. The steady-state measurement consisted of measuring the coupling coefficient between the two reactors. Also, series of measurements were performed while one of the cores was far subcritical and the coupling between the two cores was varied between 1.6×10^{-2}¢ and 1.6×10^{-1}¢ by the insertion of a water gap and from 1.6×10^{-2}¢ to 6.0×10^{-4}¢ by the insertion of a cadmium sheet between the cores. The transient portion of the study was performed by pulsing one of the reactors (the Illinois Advanced TRIGA) and following the pulse into the passive core (the Low Power Reactor Assembly). The first pulse series measured the pulse as it emerged from the thermal column and propagated through the water, where no fuel was present. This provided an analysis of the neutron source to the passive core. The second pulse series was performed with the passive core far subcritical ($k_{eff} \approx 0.94$) and investigated the effects on the transient coupling of the insertion of water gaps of up to 9 inches or a cadmium sheet ($\Sigma T = 3.2$) between the two cores. Spatial measurements of the pulse in the far subcritical assembly also were performed. The third series of pulses investigated the characteristics of the pulse in the passive core when it was subcritical, just critical, and supercritical. The effects on the FWHM of the pulse in the passive core and on the delay time between the peak of the pulse in the TRIGA and the passive core were measured for the passive core having a k_{eff} from 0.936 to 1.0015 and the initial period of the pulse in TRIGA varying from 15.6 ± 0.7 ms to 3.58 ± 0.05 ms. The FWHM increased from 13.5 ± 0.5 ms to 18.8 ± 0.5 ms and delay times increased from 3.6 ± 0.3 ms to 8.0 ± 0.3 ms with the increase in k_{eff}. The delay time decreased from 9.1 ± 0.3 ms to 7.4 ± 0.3 ms during the decrease in the initial period of the pulse. A series of pulses was also run to measure the spatial effects on the pulse in a critical core. A one-energy group point-reactor kinetics model was successfully used to describe the behavior of the system. The transient coupling coefficient between the two reactors in this model was described by a constant factor with a time displacement, which was the pulse propagation time through the connecting thermal column. The parameters found from this model agree well with those previously calculated in other studies by Miley and Doshi or those measured in the steady state. Additional models for spatial effects and for a time-dependent coupling coefficient in the transient mode were tested with the data. (auth)

13285 CRITICALITY ANALYSIS OF THE ANNULAR CORE PULSE REACTOR (ACPR) FUEL STORAGE CONTAINER. Philbin, J. S. (Sandia Labs., Albuquerque, NM). pp 2.24-2.42 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The ACPR fuel storage rack is a water moderated steel frame assembly with aluminum guide tubes and grid plates. The rack has a capacity for 90 fuel elements—10 rows of 9 elements each. A section, four inches wide, in the center of the rack is reserved for a neutron source and detectors. Quarter-inch boral plate separates each row of fuel elements from adjacent rows. The storage rack was analyzed by generating cell-disadvantaged cross sections for the fuel element rows so that the rows could be treated as homogeneous regions in slab geometry. The rack could then be described in one dimension as a series of parallel slab regions with buckling corrections for the uniform width and height of the rows. The DTF-4 code (S_N transport theory) and 16 energy group cross sections were used for the neutron transport calculations yielding a multiplication factor $k_{eff} = 0.446$. Further calculations were performed on the fully loaded storage array to assess its subcriticality on the basis of geometry alone, i.e., without taking credit for any burnable or removable poisons such as the boral plates. For these calculations the boral plates were replaced with water and the multiplication factor increased markedly, $k_{eff} = 0.945$. Criticality guides (e.g., ANSI N16.5, February 1973) indicate that computed neutron multiplication factors for storage arrays should be <0.95 using validated computational techniques. To demonstrate conclusively that the 0.95 limit is satisfied on the basis of geometry alone, additional calculations (e.g., three dimensional Monte Carlo) or experimental verification may be necessary since there has been no attempt to estimate the error introduced by the one-dimensional model or the cross section. (auth)

13286 CLOSED-FORM SOLUTION OF A TWO-DIMENSIONAL FUEL TEMPERATURE MODEL FOR TRIGA-TYPE REACTORS. Rivard, J. B. (Sandia Lab., Albuquerque, NM). pp 2.43-2.49 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

If azimuthal power density variations are ignored, the steady-state temperature distribution within a TRIGA-type fuel element is given by the solution of the Poisson equation in two dimensions (r and z). A closed-form solution of the Poisson equation is presented as a function of the axial and radial power density profiles, the conductivity of the U-ZrH, the inlet temperature, specific heat and flow rate of the coolant, and the overall heat transfer coefficient. The method begins with the development of a system of linear ordinary differential equations describing mass and energy balances in the fuel and coolant. From the solution of this system, an expression for the second derivative of the fuel temperature distribution in the axial (z) direction is found. Substitution of this expression into the Poisson equation for T(r,z) reduces it from a partial differential equation to an ordinary differential equation in r, which is subsequently solved in closed-form. The results of typical calculations using the model are presented. (auth)

13287 INCREASING TRIGA FUEL LIFETIME WITH 12 WT % U TRIGA FUEL. Naughton, W. F.; Cenko, M. J.; Levine, S. H.; Witzig, W. F. (Pennsylvania State Univ., University Park). pp 2.50-2.68 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

In-core fuel management studies have been performed for the Penn State Breazeale Reactor (PSBR) wherein 12 wt % U fuel elements are used to replace the standard 8.5 wt % U TRIGA fuel. The core configuration used to develop a calculational model was a 90-element hexagonal array, which is representative of the PSBR core, and consists of five hexagonal rings surrounding a central thimble containing water. The technique employed for refueling the core fully loaded with 8.5 wt % U fuel involves replacing 8.5 wt % U fuel with 12 wt % U fuel using an in–out reloading scheme. A batch reload consists of 6 new 12 wt % U fuel elements. Placing the 12 wt % U fuel in the B ring produces fuel temperatures (~450°C) that are well below the 800°C maximum limitation when the PSBR is operating at its maximum allowed power of 1 Megawatt. The advantages of using new 12 wt % U fuel to replace the burned up 8.5 wt % U fuel in the B ring over refueling strictly with 8.5 wt % U-Zr TRIGA fuel are clearly delineated where cost calculations used the General Atomic pre-1972 prices for TRIGA fuel, i.e., $1500 and $1650 for an 8.5 and 12 wt % U fuel element, respectively. Experimental results obtained to date utilizing the 12 wt % U fuel elements agree with the computed results. (auth)

13288 SOLUTION TO THE VARYING RESPONSE OF THE LINEAR POWER MONITOR INDUCED BY XENON POISONING. Godsey, T. A.; Randall, J. D. (Texas A and M Univ., College Station). pp 2.69-2.76 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

After conversion to FLIP fuel at Texas A&M, the fuel temperatures were examined very carefully. It was observed that the fuel temperature at 1 MW varied over a wide range during the week. This variation was shown to be due to the variation in response of the linear CIC which was used to establish reactor power level. A modification of the linear power monitor was designed and installed. The response of this system was verified by using cobalt wires, fuel temperature, and a fission chamber located at 6 feet from the reactor core. The system has proven to be operationally satisfactory. (auth)

13289 STUDY OF POWER FLUCTUATIONS IN A FLIP FUEL REACTOR USING THE TECHNIQUE OF NOISE ANALYSIS. Randall, J. D.; Wood, G. C.; Edwards, M. A. (Texas A and M Univ., College Station). pp 2.77-2.94 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The Nuclear Science Center Reactor at Texas A&M University has experienced minor power fluctuations when operating at or near 1 megawatt. A noise analysis system was developed to investigate these fluctuations assuming that void formation, primarily due to nucleate boiling, was the cause. Experiments were

carried out to correlate boiling noise with power level, fission product poisoning, and pool temperature. Results show that void formation in the core is the probable cause of the fluctuations with the onset of boiling occurring at 400 kW. Data were also obtained that indicated the presence of boiling in a standard TRIGA core. (auth)

13290 PULSED IRRADIATION OF ENRICHED UO_2 IN THE ANNULAR CORE PULSED REACTOR (ACPR). Schmidt, T. R.; Lucoff, D. M.; Reil, K. O.; Croucher, D. W. (Sandia Labs., Albuquerque, NM). pp 3.15-3.18 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

A series of experiments has been conducted in the Annular Core Pulse Reactor (ACPR) to determine the energy deposition and behavior of enriched UO_2 under pulse conditions. In the experiment single unirradiated pellets with enrichments up to 25% were pulse heated to melt temperatures. Temperature and fission product inventory measurements were made and compared with neutron transport calculations. (auth)

13291 TRIGA REACTOR AS CHEMISTRY APPARATUS. Miller, G. E. (Univ. of California, Irvine). pp 3.19-3.25 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

At the Irvine campus of the University of California, the Mark I 250 kilowatt TRIGA reactor is used as a regular teaching and research tool by the Department of Chemistry, which operates the reactor. Students are introduced to radiochemistry and activation analysis in undergraduate laboratory courses, and the relation of nuclear to chemical phenomena is emphasized even in freshman chemistry. Special peripheral items have been developed for use in graduate and undergraduate research, including a fast pneumatic transfer system for studying short-lived isotopes and arrangements for irradiations at low temperatures. These and other unique features of a purely chemically oriented operation are discussed, and some remarks appended with regard to the merits of a low budget operation. (auth)

13292 REACTOR OPERATIONS FOR NUCLEAR PUMPING OF LASERS. Beck, G.; Cooper, G. (Univ. of Illinois, Urbana). pp 3.26-3.31 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The experimental work for research on laser pumping was initiated in 1967. Emphasis was placed on direct pumping rather than enhancement. Following reactor upgrading and installation of a through beam port, a series of measurements was made on the metastable densities in pure helium, neon, and helium-neon mixtures. These experiments were followed by studies on low pressure CO_2 lasers. Most of the measurements were made at relatively low power levels (0 to 30 MW) and at a pressure of 10 torr. A gold-doped germanium detector was used to measure the output. Recent work has been performed with high pressure CO_2 lasers. Efforts have also been expended on an HF chemical laser. Initial experiments using SF_6 and CH_4 were attempted. Recently BF_3 has been substituted for the SF_6 with encouraging results. Experiments utilizing the He-Ne system have been continued, and enhancements of the electrical discharge induced laser have been observed. Although these experiments to date have utilized the ^{10}B to gain the nuclear radiation, work is presently planned on using the ^3He (n,p) reaction to obtain the excited states necessary for lasing to occur. A group of measurements was made on a nitrogen-oxygen mixture to determine the spontaneous emission obtained from the transition expected to lase. Investigations have started on a He-Hg laser where the He feeds the upper state of Hg. The laser has been built and good results have been obtained with electrical discharges (10). Plans are also underway to build a special flow system in which the buildup of the lower excited state could be removed. It is hoped that this will overcome the inherent difficulties with the relatively slow reactor pulse. The use of the reactor has caused a number of difficulties in obtaining the laser measurements. These involve radiation hazards, limits on the physical setup, and the reactor pulse width and timing. (auth)

13293 A SIMPLIFIED METHOD OF POWER CALIBRATION. Jones, M.; Elliott, A. (Univ. of Missouri, Rolla). pp 4.8-4.12 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The Nuclear Reactor Facility, University of Missouri, Rolla, has developed a unique method of power calibration for pool type reactors. Since water is incompressible it can be assumed that a rise in the water level of the pool while operating at power can be attributed to the heat input from the reactor core. Water level changes of a small magnitude are easily detectable. This method has proven to be less costly, less time consuming, and more reproducible than the conventional gold foil calibration, and has proven to be more accurate than a heat balance because several problems with heat flow through the walls and to the atmosphere are automatically compensated for with this method. The accuracy of this means of calibration depends upon the accuracy of the measurement of the water level and can normally be expected to be two to four percent. (auth)

13294 TEMPERATURE BEHAVIOR OF 12 WT % U TRIGA FUEL. Levine, S. H.; Geisler, G. C.; Totenbier, R. E. (Pennsylvania State Univ., University Park). pp 4.13-4.28 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Stainless steel clad 12 wt % U TRIGA fuel elements have been used to refuel the Penn State University's Breazeale Reactor (PSBR). When 12 wt % U fuel containing nominally 55 gms of ^{235}U per fuel element is substituted for the 8.5 wt % U fuel containing nominally 38 gms ^{235}U, higher fuel temperatures were produced in the 12 wt % U fuel than in the 8.5 wt % U fuel at the same reactor powers. The higher fuel temperature can be related to the higher power densities in the 12 wt % U fuel. The power density is calculated to be 35% higher in the 12 wt % U fuel when 6 of these fuel elements are substituted for 8.5 wt % U fuel in the innermost ring, the B ring. Temperatures have been calculated for the 12 wt % U fuel in the above configuration for both steady state and pulse conditions, assuming a 35% higher fuel density in the 12 wt % U fuel and the results compare favorably with the experimental measurements. This is particularly true when the comparison is made with temperature data taken after exposing the new fuel elements to a series of pulses. Calculations and data are presented. (auth)

13295 USE OF TRIGA-PULSED IRRADIATIONS FOR HIGH-TEMPERATURE DOPPLER MEASUREMENTS. Foell, W. K. (Univ. of Wisconsin, Madison); Cashwell, R. J.; Bhattacharyya, S. K.; Russell, G. J. pp 4.29-4.34 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Conventional activation and reactivity measurements of the nuclear Doppler Effect have been limited to temperatures of about 2000°K because of problems with furnace equipment. A technique using pulsed-mode operation of a TRIGA reactor has been developed at the University of Wisconsin to provide Doppler data at high temperatures for design of reactors and analysis of reactor accidents. High temperature Doppler measurements of UO_2 fuel pellets are described. Test pellets of UO_2 were doped with varying amounts of ^{235}U, with fissile enrichments varying from 0.22% to 12% by weight. The pellets were encapsulated in individual irradiation cells and electrically preheated to predetermined temperatures. Pyrofoam-graphite heaters were used to give preheat temperatures of up to 1720°K. The cells were then positioned in the University of Wisconsin TRIGA reactor core and pulse-irradiated. During the rapid irradiation, adiabatic fission energy deposition occurred in the pellets and very high temperatures (over 3115°K) were attained. Corresponding resonance neutron captures occurred at the elevated temperatures. The Doppler Ratio was deduced from the gamma activities of the ^{239}Np in the heated and unheated reference pellets. (auth)

13296 LOCAL, ZERO-POWER VOID COEFFICIENT MEASUREMENTS IN THE ACPR. Rivard, J. B.; Thome, F. V. (Sandia Labs., Albuquerque, NM). pp 4.35-4.40 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Changes in reactivity may be stimulated in the ACPR by the local introduction of voids into the reactor coolant. The local void coefficients of reactivity which describe this effect are of interest from a reactor safety point-of-view. Bottled nitrogen gas was used to produce the voids. The gas was forced out of a small diameter tube which was positioned vertically in the core lattice with its open end below the fuel. The gas was passed through a pressure regulator, a valve, and a flowmeter to establish a steady flow condition, following which a delayed-critical (zero-power) reactor state was established. Correlation of the average volume of core void created by the nitrogen flow with the reactivity worth of the delayed-critical control-rod bank position produced the values of the zero-power void coefficients of reactivity. The void coefficients were determined at various core positions from ~6 mm to 142 mm beyond the central irradiation space and for three different flow rates. For the range of void fractions investi-

gated, these coefficients are negative, with values ranging between −$0.02 and −$0.12. Tabular and graphical results of the measurements are presented, and details of the coefficient determination are explained. (auth)

13297 PERFORMANCE TESTING OF A MIXED TRIGA CORE. Schumacher, R. F.; Godsey, T. A.; Feltz, D. E.; Randall, J. D. (Texas A and M Univ., College Station). pp 4.41-4.47 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The major operational problem experienced by the Nuclear Science Center Reactor at Texas A&M University is full burnup. With two-shift operation caused by the high utilization of the facility, the reactor is operated more than 100 megawatt days per year. The solution chosen for this problem was conversion to FLIP fuel. Since funds were not available to load an entire FLIP core, a mixed core comprised of approximately one-third FLIP fuel located in the central region was designed. The design core was loaded and went critical on July 1, 1973. Presented are results of mixed core measurements of control rod worths, reactivity effects, neutron flux, fuel temperatures, preliminary burnup rate, and pulsing calibration. (auth)

13298 HISTORY OF EFFLUENT RELEASES FROM THE TEXAS A AND M UNIVERSITY. Bates, E. F.; Neff, R. D.; Sandel, P. S.; Schoenbucher, B. (Texas A and M Univ., College Station). pp 5.1-5.5 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Records of effluent releases of argon-41 and liquids for the past five (5) years are summarized. The data are compared to the current limits specified in 10 CFR 20 and the limits appearing in proposed Appendix I. The major gaseous effluent from the Nuclear Science Center is ^{41}Ar which is being produced at the rate of approximately five (5) curies/year. Major sources of ^{41}Ar production are the reactor pool, irradiation cell, irradiation dry tube, laboratory pneumatic systems, and the experimental beam ports. Heavy utilization of the experimental beam ports and the laboratory pneumatic systems for sample irradiations contributed to the production of 13.5 curies of ^{41}Ar in 1969. Liquid effluents originate from several sources, such as floor drains, emergency decontamination showers, radio-chemistry laboratories, demineralizer filters and ion beds, condensate from the ventilation system, and cooling equipment valve pit sump. All low level liquid waste flows to a common sump where it is transferred to storage tanks. The liquid waste is held in these tanks until its activity and isotopes are determined. The data indicate that the waste levels are within the limits specified in 10 CFR 20. (auth)

13299 EXPERIENCE WITH EFFLUENT RELEASE FROM THE OMAHA V. A. HOSPITAL TRIGA REACTOR. Blotcky, A. J. pp 5.6-5.10 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Possible sources of radioactive wastes are considered, and the maximum possible releases are compared to the limits specified in 10 CFR 20. Calculated and measured data indicate that the levels of effluent release from the facility are well within the specified limits. (DG)

13300 PUERTO RICO NUCLEAR CENTER REACTOR CONVERSION PROJECT. Brown-Campos, R. pp 6.2-6.11 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

For the purpose of upgrading the control and instrumentation system to meet new AEC requirements, to increase the available neutron flux for experimenters, and to replace burned out fuel the Puerto Rico Nuclear Center started a modification program on its old, MTR type, one megawatt reactor in March 1971. A TRIGA core utilizing the newly developed FLIP fuel, capable of operating at two megawatts with natural convection cooling and with pulsing capabilities was chosen. The major conversion tasks included: (1) modification of the bridge, tower and grid plate structures, (2) modification of the water cooling system (inside the reactor pool), (3) installation of a larger heat exchanger and cooling tower, (4) installation of a new instrumentation and control console (including neutron detectors and rod drive mechanisms), and (5) installation of a TRIGA FLIP core. Initial criticality was achieved in January 1972. For the chosen operating configuration the critical mass was 11,522 grams of uranium 235. Core excess reactivity was $7.12 and the total (5) rod worth was $12.06. During the early stages of the startup program to determine the basic core parameters and while conducting a stepwise increase in power to the design power level of two megawatts a power fluctuation on all neutron detectors was noticed. It was determined that the power fluctuations started at about 1.4 megawatts and sharply increased as power approached 2 megawatts. Experiments to determine the cause of the problem and to correct the condition were conducted in July and December 1972 and June 1973. Modifications to the core included changing fuel pin pitch and the addition of dummy elements in the central region of the core. (auth)

13301 USE OF TRIGA FLIP FUEL FOR IMPROVED IN-CORE IRRADIATIONS. Whittemore, W. L. pp 6.12-6.14 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

Use of standard TRIGA fuel (20% enriched uranium) in a reactor provides a suitable facility for in-core irradiations. However, large numbers of in-core samples irradiated for long periods (many months) can be handled more economically with a TRIGA loaded with FLIP fuel. As an example, ten or more in-core thermionic devices (each worth 50 to 80 cents with respect to a water-filled position) were irradiated in the Mark III TRIGA at General Atomic Company for 18 months with only a modest change in excess reactivity due to a core burnup. A core loading of FLIP fuel has been added to the General Atomic Mark F reactor in order to provide numerous in-core irradiation sites for the production of radioisotopes. Since the worth of a 500-gram sample of a molybdenum compound (used for the production of ^{99}Mo) is about 25 to 50 cents with respect to a water-filled position, use of a FLIP-TRIGA core will permit the irradiation of more than 5 kilograms of a molybdenum compound. A procedure is under development for the production of ^{99}Mo with relatively high specific activity. Several techniques to concentrate ^{99}Mo have been tested experimentally. (auth)

13302 COMPLETE FUEL DEVELOPMENT FACILITY UTILIZING A DUAL CORE TRIGA REACTOR SYSTEM. Middleton, A.; Law, G. C. pp 6.15-6.71 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

A TRIGA Dual Core Reactor System has been chosen by the Romanian Government as the heart of a new fuel development facility which will be operated by the Romanian Institute for Nuclear Technologies. The facility, which will be operational in 1976, is an integral part of the Romanian National Program for Power Reactor Development, with particular emphasis being placed on fuel development. The unique combination of a new 14 MW steady state TRIGA reactor, and the TRIGA Annular Core Pulsing Reactor (ACPR) in one below-ground reactor pool resulted in substantial construction cost savings and gives the facility extensive experimental flexibility and inherent safety. The 14 MW steady state reactor gives acceptably high neutron fluxes for long-term testing of various prototype fuel-cladding-coolant combinations; and the TRIGA ACPR high pulse capability allows transient testing of fuel specimens. The 14 MW steady state reactor has one large and three small in-core irradiation loop positions, two large irradiation loop positions adjacent to the core face, and twenty small holes in the beryllium reflector for small capsule irradiation. The power level of 14 MW will yield peak unperturbed thermal neutron fluxes in the central experiment position approaching 3.0×10^{14} n/cm^2-sec. The ACPR has one large dry central experimental cavity which can be loaded at pool level through a shielded offset loading tube; a small diameter in-core flux trap; and an in-core pneumatically operated capsule irradiation position. A peak pulse of 15,000 MW will yield a peak fast neutron flux in the central experimental cavity of about 1.5×10^{17} n/cm^2-sec. The pulse width at half maximum during a 15,000 MW peak pulse is about 4 msec with an integrated flux of 1.5×10^{15} nvt. The experimental facilities include a tangential and a radial beam tube from each reactor leading to an adjacent underground beam room, an underwater neutron radiography system for radiography of irradiated fuel samples and an underwater graphite thermal column. A hot cell complex for post-irradiation examination of fuel specimens is connected directly to the reactor pool by a transfer canal, permitting transfer of radioactive specimens without the need for shielded casks. The facility also has many small laboratories for preparing, analyzing, and setting up experiments. (auth)

13303 ASSESSMENT OF THE TECHNICAL SPECIFICATIONS FOR A MIXED, FLIP-STANDARD TRIGA CORE. Feltz, D. E.; Randall, J. D. (Texas A and M Univ., College Station). pp 6.72-6.76 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The Technical Specifications for the Texas A&M University mixed, FLIP-Standard TRIGA core submitted and approved under the draft version of Standard ANS-15.1 are evaluated after operating under them for over seven months. (auth)

13304 MEASUREMENT OF ONE GROUP PARAMETERS FOR ZERO ENERGY FAST CRITICAL FACILITY, PURNIMA. Godwal, B. K.; Ramakrishna, D. V. S.; Navalkar, M. P. (Bhabha Atomic Research Centre, Bombay (India)). Atomkernenergie; 24: No. 1, 69(1974).

3 figs.; 1 tab.; 3 refs.

In the fast critical zero energy facility PURNIMA, axial and horizontal values of material buckling and reflector savings were determined experimentally and compared with theoretical one-group calculations. (GE)

13305 EXPERIMENTAL STUDY OF TWO COUPLED REACTORS. Thayer, G. R.; Miley, G. H.; Jones, B. G. (Univ. of Illinois, Urbana). Nucl. Technol.; 25: No. 1, 56-67(Jan 1975).

A system composed of two coupled reactors, each of which can be made critical by itself, has been investigated. Detailed flux measurements for both steady-state operation and for large transients produced by pulsing one of the cores show that, if an appropriate formulation of the coupling coefficient is employed, a coupled point-reactor model agrees well with the experimental measurements. (auth)

Production and Materials Testing and Processing Reactors

13306 APPLICATION OF SEA-WATER EVAPORATOR FOR NUCLEAR POWER STATION. Tomura, S. (Government Chemical Industrial Research Inst., Tokyo). Genshiryoku Kogyo; 20: No. 3, 31-36(Mar 1974). (In Japanese).

In face of current energy crisis, the proportion of nuclear power emerges as highly significant. From the standpoint of its economical utilization, the multi-purpose application of reactor plants, e.g., electric power generation plus the desalination of seawater, is a possibility. This aspect of nuclear energy utilization is described: the trend of desalination technique, from past to future; desalination incorporated into nuclear power plants; technical problems in the nuclear desalination; and cost allocation between electric power and desalination. The process employed commonly in dual-purpose power plants is flash evaporation process; in this way, the overall thermal efficiency can be greatly increased. As the technical problems, there are radioactivity countermeasures, plant operation control measures to deal with water demand and supply, etc. (JA)

Propulsion and Package Reactors

Refer also to abstracts 11832 and 13326.

13307 (AD-782175) ICEBERGS ABOVE US. Elkin, A. S. 9 Apr 1974. Translation of Aisbergi Nad Nami, Moscow, 1970. (NISC-TRANS-3537). 248p. NTIS $15.50.

A documentary narrative of the operations of the USSR nuclear powered submarines is presented. (DCC)

13308 (GKSS-74/E/36) FUEL TEMPERATURE MEASUREMENT AS AN ALTERNATIVE IN-CORE POWER MEASURING TECHNIQUE. Kolb, M. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m. b. H., Geesthacht-Tesperhude (F.R. Germany)). 1974. 25p. (CONF-740537-4). Dep. NTIS (US Sales Only) $4.25.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

The pros and cons of fuel temperature measurement as an alternative to in-core power measurement by fission chambers or SPN detectors are discussed. The findings are substantiated by specific experiences gained with W3Re/W25Re thermocouples installed in fuel pins of two FDR cores. (GE)

13309 (WANL-TME-806) NRX-A CANDIDATE DIAGNOSTIC LINEAR DISPLACEMENT TRANSDUCERS IRRADIATED AT PLUM BROOK REACTOR FACILITY CYCLE 6 (PB No. 3W). Grimm, D. E.; Freas, D. G.; Pappas, T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 30 May 1964. 34p. Dep. NTIS $4.75.

To provide experimental data necessary to verify reactor mechanical design, linear displacement transducers will be used to measure the displacement of structural components in NRX reactors for cold flow and power texts. Selected candidate transducers were irradiated in the Plum Brook Reactor. The effect of a high radiation environment on the operation of these instruments was not obtained because they were severely damaged by corrosion as a result of water leaks and other problems. However, as a result of the tests, the design of the instruments can be improved by use of corrosion-resistant materials, use of dry lubricants, larger tolerances, and modifications to facilitate disassembly after irradiation. Also, proposed irradiation tests will be checked in the water mock-up loop. (LTN)

13310 (WANL-TME-809) CLEAN AREA ASSEMBLY. King, T. L. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 24 Jun 1964. 22p. Dep. NTIS $4.25.

The cleanliness requirements for NERVA are based upon one of the most critical flow parameter parts - the orifice jet - located in the core. The complete blockage of one orifice jet will cause calculated increase in temperature of 640°R in the adjacent web of the fuel element. Two adjacent blocked orifice jets will cause a calculated increase in temperature of 1240°R. Such local increases in core temperature can result in catastrophic failure. If three particles of equal size were to wedge together in the throat of the smallest orifice jet (0.0225 inches I.D.) resulting in almost complete blockage, the size of the individual particle would be approximately 0.007 inches. Based on the 0.007 inch particle, an arbitrary size of 0.006 inches or 150 microns was selected for the maximum allowable contaminant size. Protection for the orifice jets during reactor operation is provided by the Flow Screen whose grid dimensions are 0.007 × 0.007 inches. Another area of concern is the Control Drum Bearings. These bearings have clearances in the order of a few thousands of inches. Seizure of the drums could have catastrophic effects. It is essential that particulate and fibrous matter be controlled in these areas. The cleanliness requirements and controls for several work areas are defined. (auth)

13311 (WANL-TME-1124) ANALOG COMPUTER MODEL OF NRX FEEDSYSTEM. Steiner, G. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 2 Jul 1965. 27p. Dep. NTIS $4.50.

The equations used for analog computer simulation of the NRX-A feed system are presented. (auth)

13312 (WANL-TME-1139) NRX-A REACTOR-IN VESSEL SHIPPING CONTAINER: 30 FOOT DROP ANALYSIS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). Apr 1965. 49p. Dep. NTIS $5.50.

An existing shipping container was modified to accomodate the reactor-in-vessel, protect it at least as well, and be suitable for rail or truck movement without wide-load requirements. The container was subject to acceptance tests, including the requirements for shipment of Fissile Class III material (AEC Manual, Chapter 0529), which includes a requirement to sustain a 30 foot drop. The reactor-in-vessel is protected during an accident by crush systems and tensile elongation of the shipping container as energy absorbers to keep the forces on the pressure vessel within acceptable limits. The reactor will be fully poisoned for shipment. As long as the reactor and poison are contained together the shipment will remain subcritical under all foreseeable accident conditions, including a 30 foot drop. The reactor and poison are contained in the pressure vessel during shipment, hence, the reactor-in-vessel shipping container must protect the pressure vessel from rupture during any foreseeable accident condition. There is no intent to use the reactor or pressure vessel after an accident such as a 30 foot drop. Materials are expected to yield. The objective is to contain the reactor and poison. The energy absorption capability of the shipping container was analyzed in three directions, bottom, top and side. Accidents involving corner drops and drops in other attitudes were considered and in some cases extra structures were added. Generally, these conditions are less severe since the reactor-in-vessel will tend to "right" itself to the directions analyzed. (LTN)

13313 (WANL-TME-1246) EVALUATION TESTING OF THE CEC TYPE 4-125 AND 4-126 VELOCITY TRANSDUCERS. Pappas, T. A. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 20 Aug 1965. 34p. Dep. NTIS $4.75.

Consolidated Electrodynamics Corporation Type 4-125 and 4-126 velocity transducers were evaluated for possible use as diagnostic instruments on NERVA reactor tests. Non-nuclear and nuclear tests were conducted on both types. Nuclear testing was accomplished by mounting the units on one of the nozzle inlet lines of the Phoebus-1A reactor and monitoring their performance during the full power run. In general, the test results revealed that the velocity transducers operated very satisfactorily. With some redesign, the units should prove to be rugged, reliable, and accurate transducers for monitoring vibrations on the NERVA

pressure vessel, nozzle, and associated piping. With additional development, it is felt that these units could be modified so as to operate in the severe environments encountered at locations inside the reactor pressure vessel. (auth)

13314 FUEL ELEMENT CHANGE ON THE OTTO HAHN. Second Core Critical. GKSS-Inform.; No. 5, 7-9(1972). (In German).

Information about the second core of the NS "Otto Hahn" is presented. Some characteristic data for both the cores of "Otto Hahn" are compared. (GF)

Reactor Safety and Environmental Aspects

Refer also to abstracts 11240, 11241, 11248, 11262, 11292, 11293, 11659, and 11949.

13315 (AEC-tr-7589) GENERAL CRITERIA FOR THE NEW SAFETY RULES FOR SODIUM PLANTS. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Dec 1974. Translation of RTI/SIS-(73)1. 9p. Dep. NTIS $4.00.

A report is presented on the criteria proposed by the UKAEA to the IAEA in April 1973, which was subsequently discussed and approved by the Subcommittee on Safety of Sodium Plants. Several modifications and additions were incorporated as a result of extensive discussions held during the 33d meeting of the Subcommittee (30 May, 4, 5, 11, 13 June 1973), in which representatives or staff members of the following units participated: Safety Bureau, USTS, and the Industrial Chemical Laboratory. (tr-auth)

13316 (ANCR-1181) DEVELOPMENT OF INSTRUMENTS FOR TWO-PHASE FLOW MEASUREMENTS. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Oct 1974. Contract AT(10-1)-1375. 83p. Dep. NTIS $5.45.

A state-of-the-art summary on instruments developed or being developed for measuring two-phase flow in the Loss-of-Fluid Test (LOFT) and Semiscale tests is presented. Brief descriptions of the purpose, measurement principles, design and development bases, designs, and performance are given for instruments to measure fluid velocity, momentum flux, density, and level. (auth)

13317 (BAW-10099) BABCOCK AND WILCOX ANTICIPATED TRANSIENTS WITHOUT SCRAM ANALYSIS. LaBelle, D. W.; Koske, J. E.; Scott, J. F. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Dec 1974. 179p.

A study was conducted to determine the consequences of postulated anticipated transients without scram (ATWS) events for nuclear power plants designated in WASH-1270 (Appendix A) as Class B. This study also supplements previously submitted analysis in BAW-10016 on plants designated as Class C. The results are typical of transient conditions expected for Babcock & Wilcox 145-, 177-, and 205-fuel assembly plants operating at rated power level of 2631, 2772, and 3600 MWt respectively. It is concluded that the consequences of ATWS events are within the acceptable safety limits established for this study and represent no undue risk to the public health and safety. (auth)

13318 (BC-TOP-9A(Rev.2)) DESIGN OF STRUCTURES FOR MISSILE IMPACT. Linderman, R. B.; Rotz, J. V.; Yeh, G. C. K. (Bechtel Power Corp., San Francisco, Calif. (USA)). Sep 1974. 88p.

Methods and procedures for evaluating the effects of missile impact on structures are presented. A means to evaluate the change of velocity of a missile passing through a liquid is also included. Missile impact effects on structures are evaluated in terms of local damage (penetration, perforation, and spalling) and structural response. Empirical formulas are used to evaluate local effects. Structural dynamic principles are used to evaluate structural response. (auth)

13319 (BNL-19492) RADIOACTIVE EFFLUENT RELEASES AND THE PUBLIC ACCEPTANCE OF NUCLEAR FACILITY SITES. Hull, A. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 21p. (CONF-741210-4; SM-188/45). Dep. NTIS $4.25.

From symposium on siting of nuclear facilities; Vienna, Austria (9 Dec 1974).

A public controversy about the risks from radioactivity in effluents from U. S. nuclear power plants arose in the late 1960's, as their utilization was growing toward large-scale commercial basis. The controversy led to the BEIR Committee review of the effects of exposure to low levels of ionizing radiation. It also appeared to underlie the U.S. AEC's "Appendix I" proposals for numerical design limits for nuclear power plant effluents. These proposals are intended to limit the dose of any nearby individual to 5 mR/yr. Using effluent release data from recent years, the population health risk from power reactor effluent radiation exposures is shown as far smaller than that from fossil-fueled plant effluents, as well as within the range of those otherwise considered as negligible. Such comparisons are suggested as more hopeful toward achieving public acceptance than "as low as practicable measures," which serve to exaggerate the risks of radiation. (auth)

13320 (COO-2406-1) SYNTHESIS OF BREAKWATER DESIGN AND DESIGN REVIEW PROCEDURES. Ocean Engineering Report No. 1. Wang, H. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). Oct 1974. Contract AT(11-1)-2406. 308p. Dep. NTIS $18.50.

The existing design information of breakwaters proposed for the essential protective structures for power plants in offshore environments is presented. The content is generic in nature and covers all pertinent factors that need to be considered to insure adequate structural safety. Three topics are considered in detail: construction, site environment, and unique design features. Of particular emphasis is the documentation of case histories of structural failures, their causes, modes and extent of damage. Major breakwaters within and outside this country have been reviewed. Current design practice, including the selection of environmental and structural factors, and the analysis and testing procedures for environmental and structural interactions, is summarized and evaluated. An extensive literature research was performed and 519 references are documented. (auth)

13321 (INIS-mf-1337) SITING POSSIBILITIES FOR NUCLEAR POWER PLANTS IN DENMARK WEST OF THE GREAT BELT. A Review by the Working Group set up by the Ministry of the Environment to Consider the Siting of Nuclear Power Plants. (Miljoeministeriet, Copenhagen (Denmark)). Jan 1974. 47p. (In Danish). INIS.

A working group set up by the Ministry of the Environment and with representatives from other ministries which will be involved in the final approval of the siting of nuclear power plants has, on the basis of an application from the electrical power group Elsam, evaluated 45 possible sites proposed by Elsam for nuclear power plants in the Jutland–Funen area. The evaluation of the sites has been based on such factors as alternative use, population distribution, location of recreational areas, distances to existing power grids, possible use of waste heat for district heating, and thermal pollution. The working group proposes that 9 of the 45 sites shall be reserved for the purpose and further building activity out to a distance of 10 km from the sites shall be subject to regulations. (INIS)

13322 (NGI-70602-20) SEISMIC DESIGN ADVANTAGES AND DISADVANTAGES OF A SHALLOW UNDERGROUND NUCLEAR POWER PLANT. Dowding, C. H. (Norges Geotekniske Institutt, Oslo). May 1972. 30p. Dep. NTIS (US Sales Only) $4.50.

Following a brief analysis of the largest earthquake recorded in the Fennoscandinavian region, in 1904 with epicentre in or near the Oslofjord and a Richter magnitude of 6.5, the manner in which the ground motions vary with depth below the ground surface is considered. It is concluded that the peak motions at the base of a cavity will be no more than 10% lower than those at the surface. In order to obtain full advantage from an underground location the reactor vessel must be firmly braced to the rock, in this case the tensile stresses during an earthquake will be less than a quarter of those on a surface plant, and the shear stresses more than 10% less. No definite answer can be given to the question of the effect of the earthquake loading on the cavity itself. Crude estimates indicate cyclic horizontal accelerations between 1.0 and 1.5 times the accelerations at a point removed from the cavity. (NO)

13323 (RISO-M-1707) SEMIAUTOMATIC METHOD FOR QUALITATIVE FAILURE MODE ANALYSIS. Taylor, J. R. (Danish Atomic Energy Commission, Risoe. Research Establishment). Aug 1974. 22p. (CONF-740477-2). Dep. NTIS (US Sales Only) $4.25.

From meeting of specialists on the use of reliability techniques designed for nuclear installations; Liverpool, UK (8 Apr 1974).

In modern control systems, if failure mechanisms and effect are known, it is often simple to make small design changes, which lead to fail safe design. The cause/consequence diagram provides a good way of describing the sequential effects in a failure and is at present a skilled manual task. A method is presented for producing cause/consequence diagrams automatically, starting with a block diagram of the system to be analyzed, and equations de-

scribing the operation of each component, under normal and failure conditions. Theorem proving techniques are used to deduce the sequence of events occurring after a failure. (MCW)

13324 (RT/ING-(74)30) PRESSURE WAVES IN SODIUM DURING A FAST REACTOR ACCIDENT. Trombetti, T. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Aug 1974. 30p. Dep. NTIS (US Sales Only) $4.50.

The release of acoustic energy by molten fuel-coolant interaction in a fast reactor accident is described on the basis on an analytical evaluation of plane pressure wave profiles. The possibility of application and extension to curved geometries is discussed. Simple analytical expressions and graphical representations for the most important wave parameters (vaporization time, wave length, peak pressure, momentum and acoustic energy release) are given as functions of the accident conditions. (auth)

13325 (UCRL-75589) UNDERGROUND SITING OF NUCLEAR POWER REACTORS. Karpenko, V. N.; Walter, C. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1974. 22p. (CONF-741210-1). Dep. NTIS $4.25.

From symposium on siting of nuclear facilities; Vienna, Austria (9 Dec 1974).

A preliminary study of reactor siting has evolved a new concept of undergrounding that calls for excavation of an open pit. The reactor containment structure can be built using conventional construction techniques. After construction, the reactor vessel is covered with backfill material of defined permeability and porosity. Calculations show that because of this controlled permeability, radioactive seepage is confined in the backfill should an accident rupture the containment structure. The required depth of burial for complete confinement of the radioactive release is on the order of 100 m. Even a few meters of selected backfill, however, provide a dramatic reduction in the consequences of a transient release of radioactivity due to filtration and adsorption. In addition, backfill makes the reactor invulnerable to tornadoes and falling objects. Solving the containment issue in this economic manner makes close-in, metropolitan reactor siting a distinct possibility. (auth)

13326 (WANL-TME-1097) EMERGENCY COOLING LINE RELIEF VALVE REQUIREMENTS. Johnson, F. T. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA). Astronuclear Lab.). 9 Apr 1965. 26p. Dep. NTIS $4.50.

The normal flow path for both the propellant and coolant fluids used in NRX testing is through a single line routed to the engine nozzle. However, a second line directly to the reactor pressure vessel dome provides a path for an emergency purge, in the event of a failure in the normal flow path. The Test Cell design permits either gaseous hydrogen, gaseous nitrogen, gaseous helium or liquid nitrogen to be supplied to the reactor through the emergency purge line. A single pressure control valve (PCV-18) is provided in the branch line through which both gaseous hydrogen and nitrogen flow. This valve is closed during normal reactor operation, with the possibility of full tank farm bank pressure of 3500 psi on its upstream side. Since this line has recently been increased in size, it has been necessary to evaluate the need to protect the core from excessive pressures in the event PCV-18 would fail wide open. The need for a relief valve is defined, and the manner in which its setting and the capacity were determined is described. (auth)

13327 (WCAP-8290) 17 × 17 DESIGN FUEL ROD BEHAVIOR DURING SIMULATED LOSS OF COOLANT ACCIDENT CONDITIONS. Kuchirka, P. J. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Nov 1974. 50p.

Simulated loss of coolant accident (LOCA) behavior of 17 × 17 design cladding was experimentally determined by a series of single rod burst tests (SRBT). The simulated LOCA behavior for the Zircaloy-4 specimens at constant internal pressure was characterized by failure ductility and burst temperature. The results of the 17 × 17 design SRBT were statistically compared to previous SRBT results for 15 × 15 design cladding as well as to a number of 15 × 15 design SRBT executed in this program. It is concluded that 17 × 17 design cladding behaves in a similar manner to 15 × 15 design cladding. (auth)

13328 REACTOR SAFETY STUDY: AN ASSESSMENT OF ACCIDENT RISKS IN U.S. COMMERCIAL NUCLEAR POWER PLANTS. At. Energy Law J.; 16: No. 3, 177-204(Fal 1974).

A question and answer summary of the 3,300-page report by Dr. N. C. Rasmussen assessing the accident risks of nuclear commercial power plants is presented. The U. S. AEC initiated the study in September 1972 to estimate the probability of occurrence of various potential accidents in light-water nuclear power plants and of their consequences. The study includes topics dealing with the identification of accident sequences, the assignment of probabilities, fission-product transport in each accident sequence, fission-product distribution in the environment, health effects and property damage, non-nuclear risks, and interpretation and communication of the meaning of low-probability events to nontechnical readers. It is concluded that the risks to the public from potential accidents in nuclear power plants are very small. (MCW)

13329 GEOLOGIC AND SEISMIC ENGINEERING FOR NUCLEAR POWER PLANTS. Sowers, G. F. Combustion; 46: No. 6, 7-21(Dec 1974).

Information concerning the geological and seismological aspects of siting nuclear power plants is presented. The requirements of nuclear power plant structures to withstand seismic effects are discussed. Earthquake characteristics for different regions of the U.S. are described. (DCC)

13330 NUCLEAR SAFETY RESEARCH REACTOR (NSRR) PROGRAM IN JAERI. Ishikawa, M.; Hoshi, T.; Ohnishi, N.; Fujishiro, T.; Inabe, T. (Japan Atomic Energy Research Inst., Tokyo). pp 3.1-3.14 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

An outline of the NSRR program is presented. The purpose of the NSRR program is to examine the behavior of fuel rods under various accident conditions of light water reactors so as to establish realistic safety criteria and to develop analytical models for prediction of fuel failures. The experimental results are expected to contribute to the improvement of reactor design and fuel fabrication techniques. The NSRR experiments will be performed in a large central experimental tube using specially designed capsules which can accommodate up to 49 BWR type test fuels. BWR, PWR, and FBR type fuels will be examined from the beginning of life to the end of life with and without simulated reactor internal structures. The experiments will be continued for more than 10 years in three phases. The first phase of the program will be devoted to the experiments pertaining to reactivity initiated accidents (RIA). These experiments will make use of the pulsing capability of the NSRR reactor, which is expected to generate 100 MW-sec prompt energy release with 1.3 msec of minimum reactor period by a 4.7 dollar reactivity insertion and to yield more than 280 cal/g-UO_2 heat deposit in 10% enriched BWR type test fuel. Heat flow behavior from fuel to clad and from clad to coolant will be studied in order to analyze transient response of fuels. The sudden heat transient conditions created by pulsing will permit examination of each phenomenon separately according to its time delay characteristics. The second phase of the program will be devoted to experiments pertaining to power cooling mismatch (PCM) accidents and possibly loss of coolant accidents (LOCA). These experiments will be conducted at steady state power levels up to 14 MW. The third phase will be experiments pertaining to burned-up fuels. (auth)

13331 CONTROL OF CONTAINMENT OF H_2 LEVELS EVOLVED FROM ZINC PRIMERS DURING A LOCA. Lopata, J. R. Power Eng.; 78: No. 11, 48-51(Nov 1974).

It is shown that present recombiners are adequate for control of containment H_2 levels evolved from zinc primers during a loss of coolant accident in a light water reactor. (JWR)

13332 COMPUTERS FOR REACTOR SAFETY SYSTEMS. Welbourne, D. (British Nuclear Design and Construction Ltd., Whets, Eng.). Nucl. Eng. Int.; 19: No. 222, 945-950(Nov 1974).

The main conclusions of a detailed feasibility study for a computer based reactor safety system are reported. The study was based on a possible instrumentation and performance requirement for a civil fast reactor (CFR), requiring two out of three temperature and flow protection for each of 300 fuel channels, with a safety system response of 50 millisecs to trip. It was concluded that a computer system was possible, although major difficulties of suitable analogue signal scanning equipment existed. A method of working to achieve and demonstrate a high performance, diverse program system was devised. (UK)

13333 COMPARISON BETWEEN THE SAFETY OF LIQUID METAL COOLED AND GAS COOLED FAST REACTORS. Cave, L. (Pollution Prevention (Consultants) Ltd., Crawley, Eng.). Nucl. Eng. Int.; 19: No. 222, 850-853(Nov 1974).

The GCFR as a potential breeder reactor is of increasing interest since the He coolant leads to much better neutron economy than is possible with the LMFBR, and this is reflected in a much improved doubling time. Factors to be considered in comparing the safety of the GCFR with the LMFBR are discussed. Safety and economy must be considered together and doubling time must be taken into account. The merits of qualitative and quantitative methods of comparison are discussed and the safety features of both types of reactors are compared both qualitatively and quantitatively. (UK)

13334 HOW SAFE ARE NUCLEAR REACTORS. Wolf, L. Energie; 26: No. 5, 181(May 1974). (In German).
From nuclear power reactor safety course; Boston, Mass. (USA) (9 Jul 1973).
The MIT reactor safety seminar in Boston dedicated to the problems of light-water reactors is reported. Differences of opinion between the AEC and industry concerning the new AEC criteria for emergency core cooling are mentioned with industry questioning the usefulness of further tightening of the regulations. (GE)

13335 COOLING NUCLEAR REACTOR FUEL. Porter, W. H. L. (to United Kingdom Atomic Energy Authority). US Patent 3,839,150. 1 Oct 1974. Priority Date 7 Mar 1972, United Kingdom of Great Britain and Northern Ireland. 4p.
A nuclear reactor core has a supplementary or alternative means of cooling the fuel in addition to the main coolant. This means is termed auxiliary and relies upon a source independent of the main coolant. To obtain maximum benefit from auxiliary coolant this is injected as a series of intermittent high velocity jets from perforated conduits extending parallel with the fuel rods. For instance the velocity of a jet which operates for one-half second every 2 seconds would be quadrupled with no increase in average water usage. (Official Gazette)

13336 ESTIMATE OF THE HAZARDS TO A NUCLEAR REACTOR FROM THE RANDOM IMPACT OF METEORITES. Solomon, K. A.; Erdmann, R. C.; Okrent, D. (Univ. of California, Los Angeles). Nucl. Technol.; 25: No. 1, 68-71(Jan 1975).
A method and statistics given by V. E. Blake have been employed to estimate the probability per year that a nuclear reactor could be seriously damaged by a meteorite strike. The probability per year that a target area of 10^4 ft^2 will be struck by a meteorite weighing more than a pound is estimated to be 4.3×10^{-9} per reactor year. However, only a fraction of these meteorites, corresponding to weights exceeding 100 lb (0.05 ton), is very likely to seriously damage or destroy the reactor to the point of an uncontrolled release of fission products. For a vulnerable target area of 10^4 ft^2, this probability is estimated to be 7×10^{-10} per reactor year. If the vulnerable target area per reactor were 10^5 ft^2, the probability of serious damage is estimated to be 7×10^{-9} per reactor year. The probability that a coastal plant will suffer serious damage arising from either a direct hit of a meteorite or from a tidal wave induced by a meteorite is estimated to be of the order of 9×10^{-10} per reactor year for a target area of 10^4 ft^2. (auth)

13337 SAFETY AND ENVIRONMENTAL ASPECTS OF THE FIRST AUSTRIAN NUCLEAR POWER PLANT. 2. Part: Radioactive Waste Disposal, Environmental Aspects and Safety of Nuclear Power Plants. Schlosser, K. (Oesterreichische Studiengeselischaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Reaktortechnik); Ozsuszky, F. J. P. (Oesterreichische Elektrizitaetswirtschafts A.G., Vienna). Oesterr. Z. Elektrizitaetswirt.; 25: No. 2, 33-46(Feb 1972). (In German).
The radiation hazard in the environment caused by gaseous and liquid radioactive wastes from a nuclear power plant is given. The radioactive waste processing, transport and disposal are examined. Also the influence of nuclear power plants on the environment and the safety problems are discussed. The pollution caused by a 650-700 MW(e) nuclear power plant and a conventional power plant is compared. It is shown that a negative influence on the environment is lower from a nuclear power plant, constructed according to the newest technological achievements than from a conventional power plant using fossil fuels. (INIS)

Reactor Theory and Calculation

Refer also to abstracts 12749, 12751, 12752, 12760, 12762, 12763, 13060, 13123, 13165, and 13263.

13338 (CONF-741065-26) BWR NOISE SPECTRA AND APPLICATION OF NOISE ANALYSIS TO FBR. Nomura, T. (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Kanagawa. Nuclear Research Lab.). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.
From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).
Reactor noise is relatively high in boiling water reactors and is mostly due to voids and not to the coolant flow. The noise contains a lot of dynamic or stability information and noise analysis may be used as a tool for diagnosing reactor malfunction. It is useful to analyze the cross-spectral density of neutron flux, core flow, core pressure, etc., which requires a computerized Fourier analysis system. Temperature fluctuations are also being studied. (LTW)

13339 (CONF-741065-29) POWER REACTOR NOISE MEASUREMENTS IN HUNGARY. Pallagi, D.; Horanyi, S.; Hargitai, T. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Sep 1974. 12p. Dep. NTIS (US Sales Only) $4.00.
From EACRP specialist meeting on reactor noise from critical assemblies to power plants; Rome, Italy (21 Oct 1974).
Fundamental research in reactor noise was done with zero power reactors. Then reactor noise was studied at power levels with the idea of using noise measurements as diagnostic tools. For example, it was possible to distinguish different conditions in the core, such as boiling, forced cooling, etc. Coolant velocity measurements have also been made by cross correlating the fluctuations of two thermocouples mounted in the direction of flow. This was done with water and with sodium coolants. In the latter case an electro-magnetic flowmeter was also used. (LTW)

13340 (IFA-FR-121-1974) SATAN-2: CALCULATION CODE FOR MULTIGROUP EFFECTIVE CROSS SECTIONS FOR THERMAL NEUTRONS IN REACTORS MODERATED WITH WATER OR HEAVY WATER. Pasareanu, D. N.; Stefan, H. L. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 10p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.
The SATAN-2 code for neutron energy distributions in a reactor is given. The physics model on which it is based is described and the data library, input data, and the output data are summarized. (JSR)

13341 (IFA-RT-7-1974) ZERO-POWER THERMAL REACTORS WITH GLAZED CERAMIC FUEL ELEMENTS. Pavelesku, M.; Gilea, S. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 13p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.
The thermal neutron spectra and the physics parameters of the cells were calculated for a zero-power thermal reactor with different lattice spacings, different fuel radii, and four different fuel compositions. The calculations were made with the CECAS program written in FORTRAN IV. The results are tabulated. (JSR)

13342 (JUL-Conf-10, pp 164-177) ANALYSIS OF LATTICE EXPERIMENTS ON PLUTONIUM ASSEMBLIES USING HAMMER CODE. Balakrishnan, M. R.; Kumar, M. L. J. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.
From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).
In order to estimate the accuracy with which the HAMMER system of codes can predict the reactivity of plutonium fueled reactor cores, analysis of 30 critical measurements with Pu-bearing fuel was made. The results of the analysis and a brief description of the theory embodied in the code are given along with a discussion on the cross-section library used in the analysis. (auth)

13343 (JUL-Conf-10, pp 178-195) ANALYSIS OF ENRICHED URANIUM, PuO_2-UO_2 AND Pu-Al FUELED UNIFORM LATTICE EXPERIMENTS WITH CAROL AND SUCCESSOR. Bhatia, H. K. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.
From 2nd Indo-German seminar; Julich, F. R. Germany (18 Sep 1972).
Uniform lattice experiments have been performed at various laboratories in U. S. A. for enriched uranium, PuO_2-UO_2 and Pu-Al fueled lattices moderated by light water. The computer codes CAROL and SUCCESSOR have been used to analyze these lattices, and the effective multiplication factors (k_{eff}) were calculated using the experimental buckling values. Deviation of k_{eff} from unity gives an indication of the error in computing the reactivity for different lattices. (auth)

13344 (JUL-Conf-10, pp 196-216) POWER DISTRIBUTION CALCULATIONS IN WATER MODERATED ENRICHED URANIUM AND PLUTONIUM LATTICES. Kumar, V. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.
From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).
Power distribution calculations for 2.35% ^{235}U enriched UO_2 and UO_2-2 wt % PuO_2 (8% ^{240}Pu) water moderated lattices were done with the two-dimensional diffusion theory code ALCI-ALMI. Few-group lattice parameters were generated using the CAROL and DUMLAC computer codes. The calculated results have been compared with experimental values. It was observed that a 4-group model gives better agreement for power distribution in comparison with a 2-group model. The neutron spectrum near the core water boundary needs a better calculation to remove the discrepancy in power distribution. (auth)

13345 FREQUENCY DOMAIN CRITERIA FOR NUCLEAR REACTOR STABILITY. I. The Case of the Uncontrolled Reactor.

Halanay, A.; Rasvan, V. (Univ., Bucharest). Rev. Roum. Sci. Tech., Ser. Electrotech. Energ.; 19: No. 2, 367-378(1974).

An uncontrolled circulant fuel nuclear reactor is considered. The internal reactivity feedback is described by a rather general linear functional of the reactor power. Applying usual methods a frequency criterion for stability in a finite domain of the state space is obtained, together with an estimate of this stability domain. This criterion is of the Kappel-Di Pasquantonio type. 10 references. (auth)

13346 STABILITY ANALYSIS OF THE NON-LINEAR NUCLEAR REACTOR. Nguyen, D. H. (Naval Postgraduate School, Monterey, CA). Int. J. Contr.; 19: No. 3, 641-652(1974).

The stability of the nuclear reactor with temperature-dependent feedback is studied in the context of bifurcation theory of non-linear eigenvalue problems. The case of prompt Doppler effect is considered, in which the reactor temperature is proportional to the neutron flux. The multiple solutions of the non-linear boundary-value problem are constructed in the form of a perturbation expansion about the steady-state solution of the associated linear equation. The first and higher-order terms are thereby defined by inhomogeneous linear perturbation problems, which can be solved by a classical eigenfunction expansion method. The conditions for asymptotic stability, neutral stability and instability are considered. The threshold of instability "in the large" for a solution known to be stable "in the small" is also examined. (8 references) (auth)

13347 ENERGY-RELEASE PROFILING IN HETEROGENEOUS REACTOR BY VARYING MODERATOR DENSITY. Artyukhov, G. Ya.; Berezhnyak, A. I.; Dmitriev, V. M.; Istomina, I. V.; Makarenkov, Yu. D.; Nevinitsa, A. I.; Pupko, V. Ya.; Raskach, F. P.; Satina, E. P. Sov. At. Energy (Engl. Transl.); 36: No. 5, 491-492(May 1974).

Translated from At. Energ.; 36: No. 5, 389-390(May 1974).

One of the basic practical problems for a heterogeneous reactor is ensuring the necessary (in particular, unique) operating conditions for all fuel elements. This is especially significant for thermoemissive converter reactors. When such reactors are designed, a great volume of theoretical and experimental research is done to optimize the energy-release field in the core through various means: varying the fuel and moderator concentration, positioning the fuel elements, etc. Computer programs were compiled for a directed search for the optimal distributions of material in the reactor. Through neutron-physical calculations using these programs and experimental studies on the physical samples the optimal spacing of electric-generating channels in the "Topaz" converter reactor is found. The possibilities of equalizing energy release over the fuel-element height by varying the moderator density are analyzed. The energy release averaged over the fuel-element cross section is considered. This method is effective in reactors having large neutron leakage from the core, when it is difficult (for structural or technological reasons) to change the fuel concentration, the lattice spacing, etc. It may be combined with other methods for nuclear-physical reactor optimization. For the calculations a program is used to obtain a specified K_{eff} and energy-release field due to moderator redistribution in a heterogeneous reactor. 9 references. (auth)

13348 VARIANCE AND COVARIANCE IN NEUTRON COUNTING STATISTICS FROM THE BACKWARD KOLMOGOROV EQUATIONS WITH DELAYED NEUTRONS. P. 2. Arcipiani, B.; Marseguerra, M. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)). Atomkernenergie; 24: No. 1, 9-14(1974).

1 fig.; 4 refs.; with apps.

This paper is a continuation of an earlier one which deals with the neutron counting statistics in a subcritical reactor, explicitly taking into account the delayed neutrons. The systems of first order linear equations, already established in the first part of this work, are here integrated to obtain the mean value and the variance of the number of counts in a single time interval and the covariance of the number of counts in two non-intersecting intervals. The resulting expressions are discussed and compared with others already reported in the literature. (auth)

13349 GAS DISPLACEMENT AND GAS EVOLUTION IN THE FIRST CIRCUIT OF A WATER-WATER REACTOR. Kasperovich, A. I.; Bychkov, N. V.; Shiryaev, V. K. Sov. At. Energy (Engl. Transl.); 36: No. 5, 487-490(May 1974).

Translated from At. Energ.; 36: No. 5, 387-389(May 1974).

Reactor construction makes use of gas as well as vapor volume compensators (VC). The problem of gas displacement and gas evolution in the first-circuit system has been discussed. The kinetics of gas accumulation in the water in the first circuit and the feasibility of gas evolution in the cold portions (ion-exchange filters and coolers) are analyzed. (auth)

13350 USE OF S_n-METHOD FOR COMPUTING SPACE-ENERGY DISTRIBUTIONS OF FAST NEUTRON FLUXES IN REACTOR SCREEN. Broder, D. L.; Popkov, K. K.; Trofimov, I. N.; Tsvetkova, S. A. Sov. At. Energy (Engl. Transl.); 36: No. 5, 493-495(May 1974).

Translated from At. Energ.; 36: No. 5, 391-392(May 1974).

An approximate solution of the system of N integrodifferential equations was obtained by the S_n-method of Carlson; the interval of variation of μ (from -1 to 1) was subdivided into n subintervals; within each subinterval the flux and the source function were approximated by a linear function of μ. In order to increase the accuracy of the description of the angular dependences the points defining the boundary of the subintervals were more often chosen near the value $\mu = 1$, i.e., close to the predominant direction of motion of neutrons. The solution was obtained with the use of a special program developed in S_{12}-approximation for M-220 computer by the source iteration method; the solution of the system without the integral terms were used as the first iteration. The program obtains the solution for a number of energy groups not exceeding 26 at 146 computational points in plane or spherical geometry. The computational composition may contain 15 zones differing in their physical characteristics. The variant of the program used here takes into consideration the transitions of neutrons from a given energy group into the next five groups as a result of interaction processes. The same computational program is used in S_8-approximation. The procedure developed here permits to compute the space-energy and angular distribution of neutrons in heterogeneous compositions of the screen. 11 references. (auth)

13351 IMPROVED SERIES REPRESENTATION OF DOPPLER-BROADENED RESONANCE ABSORPTION. Ginsberg, A.; Becker, M. (Rensselaer Polytechnic Inst., Troy, NY). Nucl. Sci. Eng.; 56: No. 1, 106-107(Jan 1975).

An improvement made in a series representation of the $J(\theta,\beta)$ integral for Doppler broadening increases accuracy. The improvement consists of redefining the θ parameter so that the approximate Doppler-broadened line shape agrees with the exact value at the line center. (auth)

13352 GENERALIZED SOURCE-MULTIPLICATION METHOD FOR DETERMINING REACTIVITY. Greenspan, E. (Princeton Univ., NJ). Nucl. Sci. Eng.; 56: No. 1, 100-103(Jan 1975).

A new version of the source-multiplication method for measuring subcritical reactivities is presented. It does not require calibration against an independent reactivity measurement and can be applied for the determination of reactivities over the entire range of reactor shutdown. This version is compared with other source-multiplication methods. (auth)

13353 SOURCE-MULTIPLICATION REACTIVITY. Greenspan, E. (Princeton Univ., NJ). Nucl. Sci. Eng.; 56: No. 1, 103-106(Jan 1975).

A new definition of reactivity, the source-multiplication reactivity, is presented. The physical meaning of the source-multiplication reactivity is discussed, and its relationship with the static and other definitions of reactivity is investigated. The definition of correction factors required for inferring different reactivities from source-multiplication measurements is also discussed. (auth)

13354 JOINT PROBABILITY DISTRIBUTION OF NEUTRON COUNTS IN REACTOR NOISE ANALYSIS. Marseguerra, M. (CNEN, Bologna). Nucl. Sci. Eng.; 56: No. 1, 16-26(Jan 1975).

The probability generating function of the counts obtained in an arbitrary sequence of time intervals and counters is derived in the framework of the one-velocity point-reactor model without delayed neutrons. The main feature of the method is that the multiple derivatives of the probability generating function, which provide the joint probabilities and the joint moments, can be easily calculated from recurrence relations. The procedure is well suited to computer programming, and, indeed, a Fortran IV program has been written. Some conditioned probability profiles and moments thereby obtained are reported. (auth)

13355 EXPERIMENTAL DATA ON THE THERMAL NEUTRON SPECTRUM IN WATER-MODERATED REACTORS. Lomakin, S. S.; Panfilov, G. G. Sov. At. Energy (Engl. Transl.); 34: No. 2, 149-151(Feb 1973).

Translated from At. Energ. (USSR); 34: No. 2, 117-118(Feb 1973).

Neutron activation detectors employing ^{176}Lu, ^{55}Mn, and ^{63}Cu were used to measure the neutron spectral indices and cadmium ratios in three water moderated reactors. The data were used with the Westcott formalism to calculate the effective neutron temperatures. (DG)

13356 GENERALIZED PERTURBATION THEORY AND VARIATIONAL PRINCIPLE FOR MULTIPLE RATIOS OF LINEAR AND BILINEAR FUNCTIONALS. Greenspan, E. (Atomic Energy Commission, Beer-Sheva, Israel). Nucl. Sci. Eng.; 56: No. 1, 107-112(Jan 1975).

A generalized perturbation theory is derived, and a variational principle is presented, for the product of an arbitrary number of ratios of linear flux functionals and bilinear functionals in nuclear systems which are described by the homogeneous or the inhomogeneous Boltzmann equation. (auth)

13357 THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON FAST REACTOR PHYSICS. Orlov, V. V.; Kazanskii, I. A.; Nikolaev, M. N.; Troyanov, M. F. (Physical Energy Inst., Obninsk, USSR). Kernenergie; 17: No. 9, 278-284(Sep 1974). (In German).

Theoretical and experimental works on fast reactor physics are reviewed. The main directions of research in the field of nuclear data, methods of calculating fast power reactors, and experimental works on critical assemblies and power reactors are considered. 51 references. (auth)

13358 AVTOMATIZATSIYA REAKTORNYKH RASCHETOV. (Automation of Reactor Calculations). Zizin, M. N.; Zagatskii, B. A.; Temnoeva, T. A.; Yaroslavtseva, L. N. Moscow; Atomizdat (1974). 104p.

The automation of reactor calculations as a whole is examined and specific operating systems are described. A comparative analysis is made of different systems, both domestic and foreign. A language for the description of neutron physics calculations is discussed in detail. Special attention is given to the problem of exchange of calculation models and the possibilities of their use in any and all systems. (tr-auth)

13359 EXPERIMENTAL DATA RELATING TO THE THERMAL NEUTRON SPECTRUM IN NUCLEAR REACTORS. Lomakin, S. S.; Panfilov, G. G.; Kulikov, V. I. Sov. At. Energy (Engl. Transl.); 36: No. 3, 261-262(Mar 1974).

Translated from At. Energ. (USSR); 36: No. 3, 211-212(Mar 1974).

A comparison between existing theoretical and experimental data relating to the thermal-neutron energy distribution in nuclear reactors proves the necessity of allowing for the very specific effects of the chemical bond and crystal structure of the moderator in order to secure a full description of the neutron-thermalization process. Existing differences between experimental and calculated values of neutron temperature may be attributed to the fact that these effects are not allowed for in the Coveyou formula, based on the free gas model. It should furthermore be noted that the experimental neutron temperature T_n usually exceeds the calculated value. An empirical relationship linking the temperature of the medium and the parameter $\Sigma_a/\xi\Sigma_s$ to the neutron temperature is presented. In order to derive this relationship, experimental T_n data obtained in the moderators of various types of reactor cells are generalized. 15 references. (auth)

13360 ACCURACY OF THE EXPERIMENTAL METHODS USED IN THE INVESTIGATIONS OF REACTOR CHARACTERISTICS ON CRITICAL ASSEMBLIES WITH SLIGHTLY ENRICHED UO_2 FUEL AND LIGHT WATER MODERATOR. II. Dabrowski, C. (Inst. of Nuclear Research, Swierk, Poland). Nukleonika; 19: No. 10, 869-890(1974). (In Russian).

To illustrate the degree of difficulty connected with the derivation of valuable experimental results in the investigations of light water lattices with slightly enriched UO_2 fuel and to justify the accuracies recommended, remarks on the experimental inaccuracy sources have been given. The remarks concern the material buckling B^2, $d\rho/dH$ parameter, intracell parameters δ^{28}, ρ^{28}, δ^{25}, MCR, ξ as well as the SI spectral indices and related activation measurements. The most important sources of the random and systematic uncertainties are described and exemplary values of these uncertainties are quoted in tables. 26 references. (auth)

13361 SOLUTION OF A NONLINEAR INTEGRODIFFERENTIAL SYSTEM ARISING IN NUCLEAR REACTOR DYNAMICS. Pao, C. V. (North Carolina State Univ., Raleigh). J. Math. Anal. Appl.; 48: No. 2, 470-492(Nov 1974).

Reactor Components and Accessories

Refer also to abstracts 11205, 11304, 11760, 11887, and 11927.

13362 VARIABLE WORK REGIME OF THE REGENERATOR-EVAPORATOR OF AN ENERGY INSTALLATION WITH DISSOCIATING WORKING FLUID. Gimmel'shtein, Ya. E.; Greben'kov, Zh. A.; Zatsepin, O. I. (Inst. of Nuclear Energetics, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 30-34(1973). (In Russian).

The operation of a regenerator–evaporator is described for a power plant using the dissociating working substance, N_2O_4 at variation of its thermal load in accordance with the aims of regulation. 11 references. (auth)

13363 APPLICATION OF THE PULSED NEUTRON SOURCE TECHNIQUE FOR CRITICALITY CONTROL. Kind, A. (Univ., Padua); Moschini, G.; Tornielli, G. Energ. Nucl. (Milan); 21: No. 12, 693-696(Dec 1974).

An analysis on the application of the pulsed neutron source technique to reactivity measurements for safety purposes is presented. It is shown that there are practical situations in which the "area-ratio" method seems to be the most adequate, also in view of its utilization in on-line reactivity measurements of applied interest. 7 references. (auth)

13364 COMPUTERIZED MATRIX STRESS ANALYSIS OF NUCLEAR REACTOR CONTAINERS. Dveres, M. N. Mashinovedenie; No. 3, 75-81(1973).

Computer program for the static analysis of axisymmetric thin shells of revolution is discussed. The program is based on the method of initial parameters. Transfer matrices are computed from asymptotic formulas for short elastic axisymmetric shells with small deformations. (Appl. Mech. Rev.).

13365 CREEP ANALYSIS OF PRESTRESSED CONCRETE PRESSURE VESSELS BY THE FINITE ELEMENT METHOD. Shioya, S. (Nihon Univ., Narashino, Japan); Kawamata, S.; Takayama, M.; Akiyama, H.; Kanai, Y. Konkurito Janaru; 12: No. 6, 111-127(Jun 1974). (In Japanese).

The basic theory and numerical examples of creep analysis of prestressed concrete pressure vessels for nuclear reactors under the various operating conditions are presented. First, the definition of creep functions in the linear theory of viscoelasticity is reviewed, and some representative mechanical models for isotropic materials are given. For concrete, an approximate method of determination of effective creep function from experimental data is presented. Finally, example analysis of PCPV of axisymmetry subjected to prestressing forces, internal pressure and thermal loads are carried out by the finite element method of incremental time step procedure. Numerical results show some characteristics of creep deformation and stress relaxation in concrete and tendon members of PCPV. It comes out to make remarkable influence on the results due to creep Poisson's ratio adopted. (auth)

13366 MEASURING AND SIGNALLING THE FINAL CONCENTRATION OF SOLUTION BEING CONCENTRATED IN EVAPORATORS OF SPECIAL WATER TREATMENT PLANTS. Mogil'ner, I. D. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 38-40(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 29-31(1974).

The main process parameter in the water treatment systems of nuclear power plants is the concentration of the solution in the final evaporator. A method for the measurement and reference signalling of this parameter is presented. (JWR)

13367 SUPPORTING STRUCTURE FOR PRESSURE VESSEL FOR NUCLEAR REACTORS. Muto, K.; Hisada, T. (to Kajima Corp.). US Patent 3,841,593. 15 Oct 1974. Priority Date 19 Jan 1972, Japan. 6p.

A cylindrical supporting structure is connected integrally with a prestressed concrete pressure vessel for a nuclear reactor for supporting the pressure vessel thereon. The supporting structure is formed with a plurality of circumferential slits or separating surfaces to be divided into a plurality of concentric cylindrical elements so as to minimize the horizontal shearing stress produced mainly due to the thermal expansion of the vessel. Further, a plurality of radial slits or separating surfaces may be provided in the concentric cylindrical elements so as to minimize the circumferential tensile stress appearing in the cylindrical elements. (Official Gazette)

13368 HELICAL FLOW DEFLECTOR CONE FOR FUEL ELEMENT ASSEMBLIES. Calvin, J. N. (to Combustion Engineering Inc.). US Patent 3,844,888. 29 Oct 1974. Filed Date 4 Jan 1971. 6p.

A flow deflector is described for cooling fluid flowing longitudinally in channels between spaced parallel nuclear fuel reactor elements positioned laterally by intersecting grid elements. The deflectors comprise conical structures positioned at the intersections of said elements with their apexes pointed upstream in the channels and having deflecting surfaces terminating at different downstream positions, each surface having one side longer and at a smaller angle to the flow than the other

to deflect the flow laterally toward, across and spirally around the fuel elements and spirally in the opposite rotary direction in the channels. (Official Gazette)

13369 DEVICE FOR HANDLING THE ELEMENTS OF A NUCLEAR REACTOR CORE. Dumayne, R. (to Commissariat a l'Energie Atomique). US Patent 3,841,964. 15 Oct 1974. Priority Date 20 Jan 1972, France. 8p.

The device is primarily intended for use in fast reactors and comprises a first plug which is centered on the axis of the reactor core, a second rotating plug mounted eccentrically with respect to the axis of the first plug and a third plug mounted eccentrically with respect to the axis of the second plug, the eccentric displacement of the second plug with respect to the first being equal to the eccentric displacement of the third plug with respect to the second. (Official Gazette)

13370 TUBULAR CONNECTOR ASSEMBLY OF A NUCLEAR REACTOR CHARGE MACHINE. Schwarz, H. (to Aktiengesellschaft Brown, Boveri and Cie). US Patent 3,847,734. 12 Nov 1974. Priority Date 25 Mar 1971, Switzerland. 8p.

An axially movable tubular connector assembly component of a charging machine is described. The connector assembly includes a cylinder, an annular piston slidable into and out of one end of the cylinder and a cylindric open ended bellows unit located within and secured at one end to the piston crown. Pressurized fluid admitted into an annular chamber formed within the cylinder between the bellows unit and the surrounding piston and cylinder wall serves to extend the bellows unit and advance the piston so as to seat the annular crown onto the end of the stand pipe thereby to establish a charging passageway for the stand pipe leading through the open-ended bellows unit and the other end of the cylinder into the interior of the charging machine. The piston can be unseated by depressurizing the annular chamber and applying a driving force to the piston in the opposite direction. (Official Gazette)

13371 METHOD AND APPARATUS FOR REGENERATIVE HEATING IN THERMAL POWER PLANTS. Tegtmeyer, E. K. US Patent 3,842,605. 22 Oct 1974. Filed Date 25 Feb 1971. 6p.

A method is described for power plants which improves the useful life by increasing their operating efficiency. This results from elimination of the numerous conventional high pressure extraction sources for feedwater heating and the utilization of a vapor compressor to compress relatively low-pressure extraction vapor to a pressure equal to, and preferably greater than, that obtained from the previously employed plurality of cascaded high pressure extraction points. Such compressed high-pressure and high-temperature vapor is then supplied to the vapor-liquid cycle for regeneration. (Official Gazette)

13372 GATE FOR CIRCULATION CONTROL IN NUCLEAR REACTOR USING CIRCULATING FUEL-ELEMENT BALLS. Beser, A. E.; Scholz, W.; Kaiser, R.; Pohlig, N. (to Fried. Krupp Gesellschaft mit beschrankter Haftung). US Patent 3,830,693. 20 Aug 1974. Priority Date 18 Jun 1971, F. R. Germany. 4p.

A nuclear reactor having a circulation path in which fuel-element or fertile-material balls are circulated is provided with a gate or valve having a housing formed with an elongated throughgoing passage and a valve ball therein with a throughgoing bore alignable with the passage to permit throughflow and adapted to be oriented transverse to the passage axis to close the gate. The valve ball floats between two annular seals one of which is urged against the ball by a sleeve in turn biased by a spring resting on an annulus which rides on an eccentric or other cam arrangement. The housing is formed with a pair of bores transverse to the passage each of which contain a control rod a further rod and connected thereto via a double slider. One further rod is provided with a pair of pins loosely received in corresponding bores of the valve ball such that its rotation rotates the valve ball. The other second rod carries the eccentric which determines the force with which the seals grip the valve ball. (Official Gazette)

13373 DEVICE FOR HANDLING THE ELEMENTS OF A NUCLEAR REACTOR CORE. Dumayne, R. (to Societe Creusot-Loire). French Patent 2,168,199/A/. 20 Jan 1972. 15p. (In French).

The handling device comprises a first plug centered on the core axis, a second plug off-center with respect to the first plug axis and a third plug off-center with respect to the second plug axis. The off-centering of the second plug with respect to the first one is the same as that of the third plug with respect to the second one. The device is characterized in that the second and third plugs are provided with ports giving access to the reactor enclosure inside and in that the second plug is equipped with a fourth plug which is off-center with respect to the second plug axis, this fourth plug being in turn provided with a port giving access to the enclosure inside. (FR)

13374 LONG-TERM URANIUM DEMAND WILL BE MET. Fast Breeder Expected to Allow Better Utilization. Hossner, R. Handelsblatt; 29: No. 65, 5(Apr 1974). (In German). 1 fig.

The present situation on the uranium market and further ways of ensuring the uranium supply in the future are discussed. The separative work required in the future is examined. (INIS)

Reactor Fuels

Refer also to abstracts 10631, 10837, 10838, 10840, 10846, 11759, 11886, 11960–11963, and 13124.

13375 (AECL-4705) IN-REACTOR POST-DRYOUT EXPERIMENTS WITH 36-ELEMENT FUEL BUNDLES. Groeneveld, D. C.; McPherson, G. D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Dec 1973. 36p. INIS.

Post-dryout data were obtained from a string of six 50 cm long bundles of thirty-six 1.38 cm diameter elements equipped with three planes of ten thermocouples. The bundles were tested in the U-1 loop of the NRU reactor at Chalk River at nominal pressures of 68 to 102 bar. The results were compared with a previously developed post-dryout correlation. On a bundle cross-section average conditions basis the rms error in post-dryout temperature (°C) was 14%. The analysis showed that post-dryout heat transfer was least efficient near the centre of the bundle; this suggested that vapor superheating had occurred. Direct evidence of vapor superheat was also obtained. (auth)

13376 (KFK-EXT-6/74-6) EXPLANATIONS FOR THE APPLICATION OF THE COMPUTER CODE SATURN-L. Elbel, H. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). Nov 1974. 75p. (In German). Dep. NTIS (US Sales Only) $6.75.

The computer code SATURN-L is a tool which allows a detailed analysis of the behavior of a LWR fuel rod under normal operation conditions. The code determines the thermal and mechanical load as a function of the actual reactor conditions for a cross section of the fuel rod. The mutual dependence of material phenomena occurring in the fuel rod are described by means of suitable relations of material behavior models. The notes and explanations presented for the application of the code treat some aspects of the modeling and the processing of the materials properties and operation conditions. Moreover, some important details are specified which are needed for working with the code. An example of input data is given, and the structure of the code is briefly outlined. (auth)

13377 MECHANICAL EXPLANATION TO THE OVERPOWER FAILURES. Rolstad, E. (Inst. for Atomenergi, Halden, Norway). Nucl. Technol.; 25: No. 1, 7-12(Jan 1975).

Experiments have shown that pellet-clad mechanical interaction failures due to power increments often show up with some delay after the power increase has been applied. Fission-product stress corrosion has generally been accepted as the reason for this delay. It is suggested, however, that these failures may be caused by purely mechanical effects. Local plastic instability occurs during the power increase due to the stress concentrations over a fuel crack and results in the initiation of a crack at the inner wall which propagates rapidly by the local strain energy in the fuel and cladding. This strain energy may, however, not be sufficient to produce a through-going crack, and the crack propagation may stop unless more energy is supplied by further power increase; however, this energy may also be supplied by extrusion of fuel along the hot center of the rod. A simple cladding stress analysis with special emphasis on the stress concentrations over fuel cracks is included to simplify the explanation of the plastic-instability fuel-extrusion failure mechanism. (auth)

13378 MANUFACTURE OF FUEL FOR NUCLEAR REACTORS UTILIZING A POLYMERISABLE RESIN. Hrovat, M. F.; Gough, J. R. C.; Price, M. S. T. (to United Kingdom Atomic Energy Authority). US Patent 3,845,178. 29 Oct 1974. Priority Date 13 Nov 1970, United Kingdom of Great Britain and Northern Ireland. 4p.

A method of making pressed compacts of nuclear fuel in the form of fission product retaining coated particles and a matrix material incorporating a polymerisable resin is described in which the pressing is carried out with the compact in a substantially isothermal condition during which the resin melts but does not change its structure chemically. Preferably for this purpose a special phenol formaldehyde is employed. (Official Gazette)

13379 NUCLEAR REACTOR FUEL ASSEMBLY. Georges, N. J.; Pennell, W. E. (to Westinghouse Electric Corp.). US Patent 3,844,887. 29 Oct 1974. Filed Date 12 Sep 1968. 8p.

A fuel assembly comprising a plurality of spaced, parallel, and sheathed fuel bearing elements supported at a plurality of longitudinal locations within openings in laterally extending grid structures is described. Each opening in each grid structure receives a fuel element which is supported by a torsion spring having a cantilever loading arm which contacts the fuel element proximate a maximum flow area of the grid opening and by one or more non-resilient dimples in opposition to the spring. In one embodiment of a honeycomb grid lattice, the lattice is formed by preferably brazing reduced sections of preformed half-honeycombs to achieve the desired fuel element spacing. (Official Gazette)

13380 FUEL ELEMENT CAN FOR A NUCLEAR REACTOR. Boehm, H.; Borgstedt, H. U.; Ruehle, M.; Wincierz, P. (to Metallgesellschaft Aktiengesellschaft). US Patent 3,850,584. 26 Nov 1974. Priority Date 7 Mar 1970, F. R. Germany. 14p.

A fissionable-fuel element for a nuclear reactor comprises a metallic can or container and a fissionable-fuel material, such as a uranium, plutonium or thorium oxide or other compounds. The can comprises an outer shell of a material having a low neutron-capture cross section but contributing the major part of the structural integrity to the container and an inner lining resisting corrosion by the nuclear fuel. The structural or base material is a vanadium alloy consisting of 40 to 99.7 percent by weight of vanadium and specified ranges of 18 other elements. (Official Gazette)

13381 METHOD OF SEALING NUCLEAR FUEL ELEMENTS BY ELECTRIC WELDING. Boyko, E. S.; Campbell, J.; Wiggins, R. J. (to Westinghouse Electric Corp.). US Patent 3,842,238. 15 Oct 1974. Filed Date 8 Dec 1970. 8p.

A nuclear-fuel assembly has an end plug and is sealed except for a small diameter axial bore in the plug. A welding electrode of the same material as the plug has an end ground to a point. The tapered end is then inserted into the bore. Before the bore is sealed the assembly is filled with an inert-gas at high pressure. An electric welding current is then directed through the electrode and the plug to seal the bore. (Official Gazette)

13382 IN-PILE MEASUREMENT OF FUEL–CLADDING CONDUCTANCE FOR PELLETED AND VIPAC ZIRCALOY-2 SHEATHED FUEL PINS. Calza-Bini, A.; Cosoli, G.; Filacchioni, G.; Lanchi, M.; Nobili, A.; Pesce, E.; Rocca, U.; Rotoloni, P. L. (CNEN, Rome). Nucl. Technol.; 25: No. 1, 103-112 (Jan 1975).

The heat transfer coefficient between fuel and cladding has been measured in-pile for different types of Zircaloy-2 sheathed fuels: UO_2 and UO_2–PuO_2 pellets, UO_2 Vipac, and UO_2–PuO_2 Sphere–Pac sol-gel. The samples were tested in (a) instrumented rigs, in which fuel and cladding temperatures and nuclear and gamma-ray generated power were directly and continuously measured up to a heat rating of 500 W/cm, and in (b) a hydraulic rabbit at very high rating (over 1000 W/cm). Semi-empirical correlations starting from known models of fuel/clad heat transfer, based on strong or weak fuel/clad interaction, fuel cracking, and decrease in gap conductance due to oxide micro layer formation on the cladding internal surface, have been set up to fit the experimental data. (auth)

13383 COMPUTATIONAL TECHNIQUE TO ASSESS PROCEDURES FOR FAILED-FUEL IDENTIFICATION. McCormick, N. J. (Univ. of Washington, Seattle). Nucl. Sci. Eng.; 56: No. 1, 7-15 (Jan 1975).

Principles from information theory are used to obtain the minimum of the average number of shutdowns needed with a trial-and-error testing procedure for identifying failed fuel in nuclear reactors, based on a priori failure probabilities of each assembly. Also presented is the average reduction in the number of shutdowns if other information about failure is incorporated, so the merit of this other information can be assessed quantitatively. Illustrative examples are given for applications involving the use of information from flux tilting in a pressurized water reactor, gas tagging in a liquid-metal fast breeder reactor, and burnup in the Experimental Breeder Reactor II. (auth)

13384 COATED PARTICLE OXIDE FUEL FOR NUCLEAR REACTORS. Burnett, R. C. (to United Kingdom Atomic Energy Authority). US Patent 3,845,177. 29 Oct 1974. Priority Date 13 Dec 1971, United Kingdom of Great Britain and Northern Ireland. 4p.

A nuclear fuel particle comprises a kernel containing uranium oxide and coated with pyrocarbon which serves to retain the fission products. (Official Gazette)

13385 NUCLEAR FUEL COMPLEX (AN INTEGRATED APPROACH TO FUEL FABRICATION). Katiyar, H. C. (Nuclear Fuel Complex, Hyderabad, India). pp 385-415 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

Fuel constitutes one of the major recurring expenditures of an operating nuclear station. Indigenous fabrication of fuel and zircaloy components is a significant step towards self-sufficiency. The Nuclear Fuel Complex has been set up as an integrated facility to manufacture fuel and related zircaloy hardware for the current series of water cooled power reactors. Processing, fabrication, assembly, and inspection of the finished fuel have been envisaged at one location in order to have better coordination, fuller utilization, reduced inventory, and greater economy. The resultant interplay of widely different technologies has led to the establishment of a Special Materials Plant and a Titanium Plant for an entirely new range of products. A further spin off from this technological center would be the Seamless Tube Plant with a 2000 ton/year capacity supplying stainless steel tubes to chemical and process industry. A description is given of the plants and processes, which have an initial production capacity of 100 tons of RAPP-type fuel and 20 tons of TAPS-fuel per annum. Production of other zircaloy hardware required for construction of future reactors and high purity materials needed by the growing electronic industries of the country, is also planned. (auth)

Reactor Control Systems

Refer also to abstract 11427.

13386 (INIS-mf-1520) SAFARI I MINI MOD. '73. Crossland, J. R. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). 12 Feb 1973. 11p. INIS.

Further modifications and modernization of the instrumentation, protection and control of the SAFARI I reactor are given. (INIS)

13387 (INR-1434/14/R) MANUFACTURE OF CONTROL AND SAFETY RODS. Rutkowski, W.; Szteke, W.; Wieczorkowski, M. (Institute of Nuclear Research, Warsaw (Poland)). 1972. 18p. INIS.

From Polish–Italian seminar on some chemical, ceramic, and metallurgical aspects of nuclear fuels; Zakopane, Poland (29 May 1970).

Investigations were carried out on compacting techniques with boron carbide in connection with the development of control rods for experimental reactors. A high core density was obtained by hot pressing; lower core densities of B_4C were obtained by cold pressing or by a vibrational compaction technique. The control rods produced were tested in a reactor and the results are given. (INIS)

13388 DYNAMIC MODELLING AND CONTROL STUDIES FOR THE PROTOTYPE FAST REACTOR (PFR) PLANT. Butterfield, M. H. (United Kingdom Atomic Energy Authority, Winfrith, Eng.); Smith, D. C. G.; Tait, D.; Thomasson, R. K. pp 429-438 of Fast Reactor Power Stations. London; Thomas Telford, Ltd. (1974).

From conference on fast reactor power stations; London, UK (11 Mar 1974). See CONF-740318-.

The dynamic models of PFR plant that have been developed for control, fault, and performance studies are outlined. Underlying bases for the choice of control system for PFR are given together with a description of its implementation on the plant computers. Methods used for commissioning the controls are outlined and some resultant findings given. The intended program of dynamic testing on PFR is also outlined. (auth)

13389 OPTIMUM SYNTHESIS OF CONTROLLING COMPUTER SYSTEMS BY POWER ENERGY BLOCKS OF AN ATOMIC ENERGY PLANT. Tokar, M. S. (Inst. of Nuclear Energetics, Minsk). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 2, 8-15 (1973). (In Russian).

The necessity of application of the system engineering methods for control computer synthesis of the automated systems of control by the high-power blocks of APS is substantiated. Some methods, based on the queueing theory, are suggested to carry out optimal synthesis of the control computer structure and optimization of its technical characteristics. 11 references. (auth)

13390 EFFECTIVENESS OF CONTROL BLADES INSERTED INTO THE REFLECTOR REGION OF THE MOBILE EDUCATIONAL REACTOR. Tsai, J.; Chen, R. C. (National Tsing Hua Univ., Hsinchu, Taiwan). Nucl. Sci. J. (Taiwan); 11: No. 3, 111-121 (Sep 1974).

Adopting the one-and two-group neutron diffusion methods, calculations on the worth of the control blades inserted into the

reflector region of the Mobile Educational Reactor (MER) are performed by using the Hurwitz and Roe absorption area method in which the control blades are transformed into the equivalent cylindrical rods with the effective radius. The worth of these equivalent control rods is derived from the change of the critical buckling due to control rods inserted into the system. The statistical weight for the nonuniform field of the neutron flux is taken into account in order to obtain the true worth of the control blades. The reasonable result of the control blades worth, 0.5%, $\Delta k/k$ per each blade, is obtained by treating the neutrons as two groups. (5 references) (auth)

13391 ELIMINATING THE HUMAN ELEMENT AND THE DRUDGERY FROM CONTROL-ROD CALIBRATIONS. Ruby, L.; Wang, H. K. (Univ. of California, Berkeley). pp 4.1-4.7 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

The Berkeley TRIGA Mark III Reactor has three distinct reflector arrangements, depending on the position of the core in the pool. The control rods must be calibrated in each position, requiring 12 rod calibrations in all. To eliminate the human element and the drudgery involved in this repetitious task, a computer-assisted semi-automatic method has been devised to perform the necessary period methods, and to produce the resultant rod-calibration curves. The method is based on the use of a signal from the linear-power-channel recorder to feed a voltage comparator which generates a pulse at a preselected voltage "B" and also at "1.50V." The 2 pulses are used as start and stop pulses for an electronic timer, which measures the time difference to 0.01 second. The system provides nonprejudiced measurements for t_{30} as short as 5 seconds, with no concern about pen lag. The only manipulation of the data is to determine the best value of t_{30}, which is done by averaging those values which agree to within 0.1 second. The program "RODCALN" is used to calculate the rod worth remaining (in dollar units) versus control rod position, and a RODCALN provides both a table and a plot of the results. From an input of t_{30}'s obtained over the whole rod length, the program determines the reactivity for each increment of rod distance by a continuous function which approximates the table of Inhour solutions prepared by GA. The plots are of sufficient detail to be used in routine reactor operation for reactivity determinations. The differential worth results obtained with this program have been fitted to a cosine-squared function with excellent agreement. (auth)

13392 CONTROL OF THE THTR POWER STATION, UENTROP. Friedrich, K. BBC-Nachr.; 56: No. 4, 120-127(1974). (In German).

9 figs.; 2 refs.

THTR power stations provide one possibility of meeting the ever-increasing power requirements of industrial nations. The article describes the dynamic behaviour and the control scheme of the 300 MW(e) THTR power station under construction at Uentrop. The control response expected of this power station as a result of calculations made is discussed. (auth)

13393 GUIDE STRUCTURE FOR CONTROL ELEMENTS. Bevilacqua, F. (to Combustion Engineering Inc.). US Patent 3,849,257. 19 Nov 1974. Filed Date 28 Jun 1972. 14p.

A guide structure for aligning fuel assemblies forming a nuclear core of a nuclear reactor and for guiding a plurality of control elements for telescoping movement within guide channels of fuel assemblies is described. Two spaced tube sheets, rigidly connected by a plurality of hollow tubes extending therebetween, are supported by a support means relative to the nuclear core with each of the hollow tubes being in alignment with a guide channel of the fuel assemblies. A plurality of yoke means, each of which interconnects at least two of a plurality of control elements situated within some of the hollow tubes, are provided whereby the interconnected control elements telescopingly move as a unit within the guide channels. (Official Gazette)

13394 LIFT PISTON ASSEMBLY. Bevilacqua, F.; Groves, M. D. (to Combustion Engineering Inc.). US Patent 3,844,882. 29 Oct 1974. Filed Date 23 Dec 1971. 18p.

A hydraulic actuator for a nuclear reactor control rod assembly which may be positioned entirely within a reactor pressure vessel is described. The actuator is characterized by a lift piston which cooperates with the fuel assembly upper end fitting, at the lower end of the piston guide cylinder, and with a lift buffer assembly, at the upper end of the cylinder, to provide for both lifting of the control rod and for holding the control rod at the two limits of motion thereof. (Official Gazette)

13395 PRESSURE VESSEL PENETRATION TECHNIQUES. Bevilacqua, F.; Groves, M. D.; Notari, G. V. (to Combustion Engineering Inc.). US Patent 3,844,883. 29 Oct 1974. Filed Date 23 Dec 1971. 16p.

Control line penetration of a nuclear reactor pressure vessel is achieved through the side of the vessel below the junction of the vessel main barrel portion and the reactor head. The control lines enter the pressure vessel in the form of a bundle of conduits at a point which is out of the main coolant flow path and the control lines are provided with disconnect means internally of the vessel. (Official Gazette)

13396 TOP ACTUATED REACTOR CONTROL SYSTEM. Bevilacqua, F.; Dietrich, J. R.; Groves, M. D.; Flinn, W. S. (to Combustion Engineering Inc.). US Patent 3,843,471. 22 Oct 1974. Filed Date 23 Dec 1971. 14p.

A nuclear reactor control system employing a plurality of low worth absorber elements which can be individually moved between two positions respectively commensurate with full insertion and full retraction is described. Each absorber element actuator assembly is a top actuated device located entirely within the reactor pressure vessel and utilizing hydraulic pressure to control and monitor absorber element position. (Official Gazette)

13397 POSITION INDICATOR WITH NO MECHANICAL CONTACT. Pelenc, Y.; Ambier, J.; Lavergne, R. (to Etablissements Merlin et Gerin). French Patent 2,169,437/D/. 24 Jan 1972. 20p. (In French).

The invention is adapted to sense the position of a moving member. As that member moves, a magnetic part having the shape of a plunger piston changes the inductive coupling between a primary winding and pairs of secondary windings. The signals are applied to electronic circuits adapted to deliver a voltage signal which is proportional to the displacement of the member. This position detector can be used for sensing the position of the control elements of a nuclear reactor. (FR)

13398 INSTRUMENTATION AND CONTROL OF CANDU TYPE REACTORS. Prabhakar, B. S. pp 303-331 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

The instrumentation and control needs of a nuclear power plant can be broadly put into four categories — conventional plant control, reactor process control, neutron power control, and reactor safety devices and radiation control. While the first two are similar to what is used in conventional power plants, the others are unique to nuclear plants. The variety of possible nuclear reactors is so large that reactor power control and safety features have been very diverse. PHWR type reactors have pushed forward the original concepts employed in the NRX reactor, such as moderator level control, moderator dumping, on-load fuel handling and on-power testing. The use of heavy water as the process fluid has also led to special development efforts in the instrumentation area. The BLW is a recent concept which has introduced new efforts in control and safety aspects of PHWR type reactors. The increased size of the recent PHWR type stations and the progress in control technology have led to changes such as extensive computer control and in-core flux monitoring for control and has also resulted in the elimination of moderator dumping as a safety feature. The Indian nuclear power stations have generally followed the Canadian pattern, the main accent being placed on the indigenization program, with design changes being made towards increasing indigenous content. In RAPP-1, the instrumentation and control cost is about Rs.3 crores, which is about 5% of the total plant cost; the indigenous content is about 40% and is expected to reach 70% in the next reactor. (auth)

13399 EVALUATION OF DETECTOR-EFFICIENCY AND SOURCE-WORTH CORRECTIONS FOR SUBCRITICAL REACTIVITY MEASUREMENTS IN A FAST CRITICAL ASSEMBLY. Kaiser, R. E. (Argonne National Lab., Idaho Falls, ID). Nucl. Technol.; 25: No. 1, 138-149(Jan 1975).

Analytical corrections for the effect of subcritical reactivity on B_{eff}, detector efficiency, and ^{240}Pu source worth in control-rod-group worth measurements in zero-power plutonium reactor Assembly 3 have been evaluated. Calculations of each factor were performed for a number of subcritical configurations; the results are presented and compared to the critical reference case. An evaluation of the method is included to establish a logical and efficient procedure for determining such corrections for future assemblies, which shows that extrapolations between similar configurations can be made accurately on the basis of only one or two rod patterns. (auth)

13400 ISOLATION VALVE AND CONTROL SYSTEM EMPLOYING THE SAME. Bevilacqua, F.; Flinn, W. S.; Groves, M. D. (to Combustion Engineering, Inc.). US Patent 3,844,884. 29 Oct 1974. Filed date 31 Jul 1972. 8p.

An isolation valve particularly well suited for use in nuclear reactor hydraulic control systems is disclosed. The valve includes an electro-magnetic actuator which may be energized to open the valve thereby permitting the lift flow needed to move fission rate control devices with respect to a fuel assembly. The fission rate control devices are provided with elements comprised of magnetic material which, with the devices fully retracted from the fuel assembly, will be positioned within the magnetic field generated by the valve actuator whereby the devices will be magnetically held in the retracted position. (Official Gazette)

Nuclear Power Plant Economics

13401 (PB-223501) FEASIBILITY STUDY OF A NUCLEAR POWER-SEWAGE TREATMENT SYSTEM FOR THE CONSERVATION AND RECLAMATION OF WATER RESOURCES. Completion Report. Sierka, R. A. (Arizona Univ., Tucson (USA)). Aug 1973. Contract DI-14-31-0001-3503. 14p. (W-73-14360; OWRR-A-028-ARIZ(2)). NTIS $2.75.

Seventy percent of the energy produced in a nuclear power reactor is rejected to the environment as low quality heat. One possible use of this heat source is for domestic waste water treatment. A ferric-chloride, powdered activated carbon and an aluminum sulfate, powdered activated carbon physical-chemical system are examined in a one-step process. As a function of temperature (20-80°C). COD, suspended solids, turbidity and phosphorus removals were used to monitor performance. Significant improvement in pollutant removals was obtained at higher temperatures with the optimum results occurring between 50 and 60°C. Since urban waste water flow and electric power usage are population-dependent and the system optimum treatment temperature coincides with waste heat characteristics, a combined power-plant-waste water system would generate recycle water. (auth)

13402 (PB-226141) USE OF POWER PLANT HEAT IN A PHYSICAL-CHEMICAL DOMESTIC WASTEWATER RENOVATION SYSTEM. Sierka, R. A.; Fazzolare, R. A. (Arizona Univ., Tucson (USA)). Apr 1973. Contract DI-14-31-0001-3503. 32p. (CONF-730433-). NTIS $3.75.

From national conference on complete water use; Washington, District of Columbia, USA (23 Apr 1973).

Seventy percent of the energy produced in a nuclear power reactor is rejected to the environment as low quality waste heat. One possible use of this heat source is for domestic wastewater treatment. This study examines a ferric-chloride, powdered activated carbon physical-chemical system in a one-step process as a function of temperature (20-80°C) with COD, suspended solids, turbidity, and phosphorus removals used to monitor performance. Significant improvement in removal is obtained at higher temperatures with optimum results between 50°C and 60°C. Since urban wastewater flow and electric power usage are population-dependent and the system optimum treatment temperature coincides with waste heat characteristics, a combined power plant-wastewater system would generate recycleable water. (auth)

13403 DETERMINATION OF THE RATED LIFE OF ATOMIC POWER STATIONS. Gitel'man, L. D.; Ratnikov, E. F.; Khanin, V. V. At. Energ. (USSR); 37: No. 4, 291-296(Oct 1974). (In Russian).

Results of investigations in determining the useful life of power blocks are presented. The information required for calculations was based on estimates of future advances in atomic engineering by specialists in the field. Equations of regression, characterizing changes in time of the capacity of single reactors based on thermal and fast neutrons, and estimates of mathematical expectancy for putting into service atomic power blocks with reactors based on fast neutrons and MGD generators are presented. Calculations performed using a special computer program made it possible to conclude that the service life till total depreciation of atomic power blocks put into operation during the present five-year plan will be not less than 30 years. 12 references. (auth)

13404 STANDARDIZATION OF NUCLEAR POWER PLANTS WITH LIGHT WATER REACTORS. Diederichs, M. (Kraftwerk Union A. G., Frankfurt am Main (F. R. Germany)). VGB Kraftwerkstechnik; 54: No. 9, 578-582(Sep 1974). (In German).

9 figs.

The growing requirements and increasing procedural difficulties associated with the installation and operation of nuclear power stations require new techniques for nuclear power plant construction. Far-reaching steps have been taken towards standardization. The obstacles to be overcome are itemized, analyzed, and compared with expectations, using examples. (auth)

13405 TOPIC PAPERS ON THE REACTOR CONFERENCE 1974 AT BERLIN, 2 TO 5 APRIL 1974. Atomkernenergie; 23: No. 4, 292-296(1974). (In German).

From reactor conference; Berlin, F. R. Germany (2 Apr 1974).

Summaries of the most important specialist lectures on reactor design and experiments, fuel elements, fuel cycle and isotope techniques, layout, construction and operation of nuclear reactor plants and their components, and reactor concepts and economics are given. (GE)

13406 THE PROSPECTS OF THE NUCLEAR POWER ECONOMY DEVELOPMENT IN THE COMECON STATES. Gorskov, A. L. Arch. Energiewirt.; 28: No. 18, 879-889(Sep 1974). (In German).

3 tabs.; 12 refs. Translated from Energochoszjajstvo za rubezom, 1974, No. 3, p. 5-11.

Following an explanation of the cooperation in the interconnected grid, the economic conditions for nuclear power plant construction as well as details on developments in the individual member countries up to the year 2000 are described. In the COMECON states, pressurized-water reactors chiefly of Soviet type construction are being used, with the help of which an annual rate of increase of energy production of up to 7% should be achieved. (GE)

13407 OPTIMIZING THE UTILIZATION OF NUCLEAR POWER PLANTS IN THE POWER SYSTEM. Ackermann, G.; Luetzow, K.; Hentschel, G. Kernenergie; 17: No. 10, 304-307 (Oct 1974). (In German).

At present, the fraction of nuclear power in the national and international power systems is going to increase considerably. Along with this, in future, the thermal reactors are expected to be displaced from the range of basic load to that of medium load. This evolution makes full integration of nuclear power plants into optimum utilization of the power systems necessary. The status of technological fitness of the nuclear power plants for meeting the requirements on the part of the mains, the features resulting from nuclear fuel economy, and the recent status of mathematical methods for planning utilization of nuclear power plants in the power system are considered. With that, emphasis is on the nuclear power plants with pressurized-water reactors. Problems of optimizing the structure of the individual power plants and their sites are not considered. 35 references. (auth)

13408 METHOD FOR CALCULATION OF THE MAIN ECONOMIC PARAMETERS OF THE NUCLEAR PLANTS FOR THE COMBINED ELECTRIC ENERGY GENERATION AND IRRADIATION. Breger, A. Kh.; Dobrovol'skij, S. P.; Stariznyj, E. S. Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 3, 46-49(1973). (In Russian).

A method for the calculation of the reduced cost in the production of electrical energy and γ radiation was proposed. According to the method the distribution of capital costs is done proportionally to the cost of the forms of the products of complex installations under the assumption of a fixed value of the cost of electrical energy and determination of the cost of γ radiation by the isolation method. (tr-auth)

13409 ON DEVELOPMENT OF NUCLEAR ENERGETICS. Barchenkov, A. P. At. Tekh. Rubezhom; 2: 19-22(Feb 1974). (In Russian).

Data on the output and yield of nuclear power plants in the principal capitalistic countries in 1970 to 1973 were reported. Predictions on the growth of the output of nuclear energy up to 1985 were made. Data on the U reserves in the capitalistic countries were reported. (tr-auth)

13410 (CONF-730371-) PROCEEDINGS OF THE SYMPOSIUM ON NUCLEAR SCIENCE AND ENGINEERING, BHABHA ATOMIC RESEARCH CENTRE, TROMBAY, MARCH 13-17, 1973. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 493p. Bhabha Atomic Res. Centre, Govt. of India.

Included are thirteen invited papers and the ensuing discussions as well as the discussions on the contributed papers. Topics covered include reactor construction, fabrication of reactor components, reactor engineering, reactor physics, control systems, reactor safety, shielding, reactor operation, coolant water chemistry, and fuels and materials. A listing of the 209 contributed papers is given. Seven papers have been separately abstracted and indexed. Six papers were previously abstracted and appear as abstract numbers 29:11637, 29:12201, 29:12048, 29:11740, 29:12017, and 29:07856. (DG)

For abstracts of individual papers see: 13142, 13183, 13184, 13259, 13385, 13398, and 13411.

13411 ROLE OF BARC IN THE DEVELOPMENT OF INDIA. Ramanna, R. (Bhabha Atomic Research Centre, Bombay). pp

11-37 of Proceedings of the Symposium on Nuclear Science and Engineering. Bombay; Bhabha Atomic Research Centre (1973).

From proceedings on nuclear science and engineering; Bombay, India (13 Mar 1973). See CONF-730371-.

Past activities and achievements of the Bhabha Atomic Research Center are briefly reviewed, and the future role of BARC in areas such as ecology research, mass transportation, laser technology, and medical instrumentation and irradiation applications is considered. (DG)

13412 COMPLEX OPTIMIZATION OF THE NUCLEAR POWER PLANT PARAMETERS IN THE CASE OF A DISSOCIATING WORKING SUBSTANCE. Part 2. Popyrin, L. S.; Starostenko, N. N. (AN SSSR, Irkutsk. Sibirskij Ehnergeticheskij Inst.). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 3, 54-60 (1973). (In Russian).

A description was given of two modifications of the thermal circuits of a nuclear power plant. An analysis was made of the effect of the basic parameters on the characteristics of these circuits. The principles of the complex optimization of the parameters of a nuclear power plant with dissociating gases used as coolant were discussed. A description was given of the optimization algorithm. The results of the complex optimization of the parameters of three circuits for a nuclear power plant were reported and their economic efficiencies were compared. (tr-auth)

13413 MARKET SURVEY FOR NUCLEAR POWER IN DEVELOPING COUNTRIES. General Report. Vienna; IAEA (Sep 1973). 61p.

Appendixes A-P.

A survey of the potential market for nuclear power plants during 1980-1989 in 14 countries is presented. The objective of the survey was to determine the size and timing of plants that could be economically justified in these countries. The social and economic factors considered and the methodology of the evaluation are summarized. The countries studied included: Argentina, Bangladesh, Chile, Egypt, Greece, Jamaica, Mexico, Pakistan, Philippines, Korea, Singapore, Thailand, Turkey, and Yugoslavia. (HDR)

13414 REVIEW OF OPERATIONAL RESULTS OF NUCLEAR POWER PLANTS. Brune, W. (VEB Kernkraftwerk, Greifswald, Ger.). Kernenergie; 17: No. 9, 269-277(Sep 1974). (In German).

A review of the operational results of nuclear power plants is given ranging up to Dec. 31, 1973. As concerns gross electric power release, the British gas cooled power plants are in front with more than 25,000 GWh. Up to the end of 1972, about 750 TWh of electric power were produced by nuclear power plants in total. Mean availability of work of all the nuclear power plants under operation is about 60 to 70 per cent. Moreover, annual availability of time of both the whole plants and the nuclear steam generating system, availability of time in special reactor campaigns and winter half-years, and a five-year availability are given for selected nuclear power plants. The operational results of the experimental, prototype, and demonstration power plants have given reasons for the impetuous development of nuclear power economics in the last few years. 23 references. (auth)

Reactor Fuel Cycle Economics

Refer also to abstracts 13124, 13154, 13155, and 13407.

13415 (AEC-tr-7576) REMOTE NUCLEAR HEATING AND REMOTE NUCLEAR ENERGY. Bohn, T. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany)). Jan 1975. Translation of JUL-1077. 49p. Dep. NTIS $4.00.

A preliminary survey of the possibility of using nuclear energy for the supply of heat to homes, small users and industry is presented. Because of the early stage of these considerations, the costs and quantities indicated must be considered first estimates. Nevertheless, we can conclude that the use of nuclear energy offers economic advantages in comparison to current, conventional methods, as well as advantages with respect to supply dependability and raw material conservation. In this respect there is no difference between "Remote Nuclear Heating" and "Remote Nuclear Energy." The utilization of waste heat from current generating processes "remote nuclear heating" can contribute as much to environmental preservation as "remote nuclear energy" contributes because of its decentralized, local current generation. (auth)

13416 (CONF-741032-1) NUCLEAR REACTOR PROCESS HEAT CAPABILITIES, POTENTIAL, AND ECONOMICS. Trauger, D. B.; Bennett, L. L. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From 1st national topical meeting on nuclear process heat applications; Los Alamos, New Mexico, USA (1 Oct 1974).

Nuclear reactors are well-established as an economical energy source for electrical power generation, and nuclear energy is projected to contribute 70% of the energy used for generating electricity in the year 2000. While this is a significant contribution by nuclear energy to the Nation's energy needs, the non-electric or industrial sector is an even larger energy user which is yet to be served by nuclear energy. A present-day limitation of nuclear power plants is that they are all steam producers, whereas many industries need high-temperature process heat in addition to steam. The higher temperature energy presently supplied by oil and gas cannot be met by existing reactor designs. However, with slight modifications, the General Atomic Company's HTGR can reach core outlet temperatures of 870-980°C (1600-1800°F). The German pebble-bed reactor is reported capable of reaching core outlet temperatures as high as 1150°C (2100°F). Achievement of these temperature capabilities would allow the gas-cooled reactors to supply process heat as well as industrial steam requirements. Additional research will be needed on reactor design and materials for operation at such high temperatures. The cost of steam from nuclear reactors for industrial uses was evaluated. Nuclear energy costs have been compared with coal or refined-coal fuels at a U.S. Gulf Coast location. These studies indicate that, in large sizes, the LWR and HTGR can provide process steam at lower cost than coal-based plants. While the CNSG is smaller than conventional LWRs, and therefore a more appropriate size for many industrial applications, the unit energy cost is significantly higher than from larger nuclear plants (due to economies of scale) or from a variety of coal fuel cycles. (auth)

13417 (INIS-mf-1565) PROSPECT OF PLUTONIUM USAGE IN BRAZILIAN POWER REACTOR PROGRAMS. Castro, J. C. (Minas Gerais Univ., Belo Horizonte (Brazil)). Nov 1971. 226p. (In Portuguese). INIS.

Thesis.

Initially the problem of determination of plutonium production is considered; a comparison is made between theoretical calculation (fuel cycle) and experimental measurements. In the Pu extraction step the cost per kilo of reprocessed fuel is analyzed, taking into account present and developing techniques. Next the uses of plutonium are discussed, considering alternative possibilities and their technical economic implications. In the study of the Pu market a prediction is made of the market price of this material. Once the viability of Pu use as reactor fuel is established, the prospect of its application in the particular case of the Brazilian nuclear program is studied. The work is restricted to analysis of the extreme strategies of Pu utilization, comparing them through uranium consumption and separative work. (INIS)

13418 (JUL-Conf-10, pp 1-18) SOME CONSIDERATIONS OF UTILIZATION OF PLUTONIUM IN INDIAN CONDITIONS. Rastogi, B. P.; Srinivasan, K. R.; Bhatia, K. K.; Balakrishnan, M. R. (Bhabha Atomic Research Centre, Trombay, India). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

A survey type study regarding the utilization of plutonium produced from the first generation power reactors in India, TAPS, RAPP, MAPP, and others is presented. Depending on specific national requirements and economic considerations, plutonium could be used either for fast breeders or could be recycled in the same reactors, in other power reactors, or in experimental reactors. Comments on the development of physics analysis capabilities and plutonium technology are also made. (auth)

13419 (JUL-Conf-10, pp 19-44) FUEL RECYCLING IN LIGHT WATER REACTORS. Stoll, W. (ALKEM GmbH, Wolfgang, Ger.). Dec 1973.

From 2nd Indo-German seminar; Jülich, F. R. Germany (18 Sep 1972).

Plutonium supply projections based on present and planned operation of uranium-fueled reactors are discussed, and the prospects for utilizing plutonium in fast breeder reactors and in light water and high temperature reactors are compared. The advantages and disadvantages of using plutonium in light water reactors are weighed, and estimates are made of the future market for plutonium recycle fuel. (DG)

13420 (WASH-1348) COMPUTER PROGRAM NUFUEL FOR FORECASTING NUCLEAR FUEL REQUIREMENTS AND RELATED QUANTITIES. Snyder, A. J. (USAEC Office of Planning and Analysis, Washington, D. C.). Oct 1974. 149p. Dep. NTIS $7.60.

A detailed description is given of the computer program which is used to calculate the annual requirements for separative work and uranium which accompany the AEC's periodic forecast of nuclear power growth. Calculations assume that uranium enrichment plants approximate ideal cascade conditions. Plutonium production and requirements and demands for UF_6 conversion, fuel element fabrication, and spent fuel reprocessing are also considered. Input to the program is a schedule of nuclear power plant additions by reactor type. Reactor characteristics and fuel cycle data for each reactor or each type of reactor are also used as input. The methods of calculation, the data sets needed to run the program, the printed output, and the options available are discussed. Included are listings of the source deck, a set of control cards, and the data sets for a sample case. The output for the sample case and input for several reactor types are also included. (auth)

13421 INVESTIGATIONS ON THE APPLICATION OF BURNUP STRETCHOUT. Hentschel, G. (VEB Kernkraftwerk, Greifswald, Ger.). Kernenergie; 17: No. 10, 319-324(Oct 1974). (In German).

Decreasing the load of a nuclear power plant for purposes of reactivity gain at the end of campaign means an operational régime that offers favourable possibilities in reference to both fulfilling the requirements on the part of the mains and utilizing the nuclear fuel. Various versions of application are discussed and studied using a method which is elucidated in its principles. Preliminary results are given. 12 references. (auth)

13422 INVESTIGATING THE OPTIMUM UNIT CAPACITY AND THE COMPOSITION OF THE MAIN ITEMS OF PLANT FOR NUCLEAR HEAT AND POWER STATIONS. Il'kevich, Z. A.; Lovental, G. B.; Smirnov, I. A.; Khrilev, L. S.; Shadrin, A. P. (Siberian Power Inst., Novosibirsk, USSR). Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 4-9(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 3-7(1974).

A study on the optimum capacity and composition of the main plant components in a dual purpose nuclear heating and power plant is described. The factors considered included: the magnitude and rate of increase of heat load; the capital investment required; electricity costs; the cost of fossil fuels; and the degree of utilization of the nuclear fuel. (JWR)

Reactor Licensing and Regulation

Refer also to abstracts 13132 and 13166.

13423 (RAI-74-11) REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, NOVEMBER 1974. (USAEC Technical Information Center, Oak Ridge, Tenn.). Dec 1974. 126p. TIC $2.50.

Issuances received from the U. S. Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (LTN)

13424 (RDT-INDEX-11-74) INDEX OF RDT STANDARDS. (USAEC Division of Reactor Research and Development, Washington, D. C.). Nov 1974. 43p. RSO.

13425 (REG/G-1.70.16(12-74)) INFORMATION FOR SAFETY ANALYSIS REPORTS: MISSILE BARRIER DESIGN PROCEDURES. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 3p. DRS Free.

Information on missile barrier design procedures required in safety analysis reports is identified. (DG)

13426 (REG/G-1.92(12-74)) COMBINATION OF MODES AND SPATIAL COMPONENTS IN SEISMIC RESPONSE ANALYSIS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 3p. DRS Free.

Guidelines are presented for the combination of modal responses as well as spatial components in the seismic analysis of nuclear power plants. (JWR)

13427 (REG/G-1.93(12-74)) AVAILABILITY OF ELECTRIC POWER SOURCES. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Dec 1974. 9p. DRS Free.

Operation procedures and restrictions, to be implemented at nuclear power plants when the available electric power sources are less than the limiting conditions for operation, are presented. (JWR)

13428 IMPACT OF PROPOSED RESEARCH REACTOR STANDARDS ON REACTOR OPERATION. Ringle, J. C.; Johnson, A. G.; Anderson, T. V. (Oregon State Univ., Corvallis). pp 6.77-6.87 of TRIGA Owners' Conference III. San Diego, CA; General Atomic Co. (1974).

From TRIGA owner's conference III; Albuquerque, New Mexico, USA (25 Feb 1974). See CONF-740206-.

A Standards Committee on Operation of Research Reactors, (ANS-15), sponsored by the American Nuclear Society, was organized in June 1971. Its purpose is to develop, prepare, and maintain standards for the design, construction, operation, maintenance, and decommissioning of nuclear reactors intended for research and training. Of the 15 original members, six were directly associated with operating TRIGA facilities. This committee developed a standard for the Development of Technical Specifications for Research Reactors (ANS-15.1), the revised draft of which was submitted to ANSI for review in May of 1973. The Committee then identified 10 other critical areas for standards development. Nine of these, along with ANS-15.1, are of direct interest to TRIGA owners and operators. The Committee was divided into subcommittees to work on these areas. These nine areas involve proposed standards for research reactors concerning: (1) records and reports (ANS-15.3), (2) selection and training of personnel (ANS-15.4), (3) effluent monitoring (ANS-15.5), (4) review of experiments (ANS-15.6), (5) siting (ANS-15.7), (6) quality assurance program guidance and requirements (ANS-15.8), (7) restrictions on radioactive effluents (ANS-15.9), (8) decommissioning (ANS-15.10), and (9) radiological control and safety (ANS-15.11). The present status of each of these standards is presented, along with the potential impact on TRIGA reactor operation. (auth)

13429 SAFETY PROBLEMS OF NUCLEAR POWER STATIONS. Bukrinskii, A. M. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 2, 10-13(Feb 1974).

Translated from Teploenergetika; 21: No. 2, 8-10(1974).

Special requirements in the design and construction of nuclear power plants, necessary to insure safety in normal and emergency conditions, are discussed. (JWR)

GENERAL AND MISCELLANEOUS

Civilian Defense

13430 (AD-785521) EXPERIMENTAL COMPARISON OF BURIED AND MIXED SOURCE GROUND ROUGHNESS RESIDUAL RADIATION MODELS. Final Report. Maloney, J. C. (Ballistic Research Labs., Aberdeen Proving Ground, Md. (USA)). May 1974. 162p. (BRL-1717). NTIS $5.00.

The overall objective of this project was to develop and test radiological countermeasures that are applicable to post-nuclear-attack recovery operations. The specific objective of the work reported herein was to measure the direct and scattered components of radiation exposure from buried and mixed source models postulating the shielding effects of ground roughness, and to compare the results with available Monte Carlo calculations. (GRA)

Energy Utilization and Economics

13431 (BNL -19229) PROGRESS AT BROOKHAVEN IN THE DESIGN OF HELIUM-COOLED POWER TRANSMISSION SYSTEMS. Forsyth, E. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 30 Sep 1974. 8p. (CONF-740957-8). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Following an extensive study of cryogenic power transmission systems under development in this country and abroad it was concluded at Brookhaven that a flexible superconducting ac cable appeared to be the best choice for an economical high-capacity underground system with superior technical characteristics. A form of niobium-tin has been developed for this application with an intrinsic low-loss performance at 60 Hz. In addition, it was determined that the ac characteristics of many commercial forms of Nb_3Sn are degraded by additives, these effects are described. A flexible cable will require a lapped plastic insulation which must possess necessary properties both at room temperature and at the operating temperature, these are listed together with a summary of test results. Several designs for the cryogenic envelope to contain the cable are under development, the design options and trade-offs are discussed. Using performance data based on present knowledge of helium-cooled cables, systems were designed for an actual utility company transmission corridor 43 miles long rated at 4800 MVA. These designs are costed and compared to conventional transmission facilities. (auth)

13432 (BNL-19308) COAL COMBUSTION AND DESULFURIZATION IN A ROTATING FLUIDIZED BED REACTOR. Chalchal, S.; Sheehan, T. V.; Steinberg, M. (Brookhaven National Lab., Upton, N. Y. (USA)). Oct 1974. 24p. Dep. NTIS $4.25.

The use of coal as a fuel for electrical power generation is limited by its sulfur content, resulting in high sulfur pollution of the flue gas from its use in conventional combustion. Sulfur removal can be achieved by burning the coal with limestone and dolomite in a fluidized bed. An evaluation of the fluidized bed combustion process is made and the principles of rotating fluidized bed combustion are presented. A preliminary design of a pressurized fluidized bed combustor is given. (SFL)

13433 (BNL-50421) OPERATING MANUAL FOR THE PSE AND G HYDROGEN RESERVOIR CONTAINING IRON TITANIUM HYDRIDE. Strickland, G.; Reilly, J. J. (Brookhaven National Lab., Upton, N. Y. (USA)). Feb 1974. Contract AT(30-1)-16. 39p. Dep. NTIS $4.00.

This manual is written for personnel concerned with operation of the hydrogen reservoir which Brookhaven National Laboratory (BNL) built for Public Service Electric & Gas Co. (PSE & G) for use in their experimental energy-storage system. Information is provided on how the reservoir functions and how it can be safely operated. The equipment is described and basic operating procedures are given along with precautionary measures. Some of the material presented here will also appear in the project report, and some of the material will supplement that in the report. As operating experience is gained, more detailed procedures can be prepared for interfacing the reservoir with the other major components comprising the energy-storage system. (auth)

13434 (KFK-1984) INVESTIGATIONS CONCERNING THE MODELING OF COOLING TOWER PLUMES IN SMALL-SCALE EXPERIMENTS. Werle, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Aug 1974. 73p. (In German). Dep. NTIS (US Sales Only) $6.75.

The conditions representative for real cooling towers can be modeled in a small low-speed wind tunnel. Measurements of the space distribution of velocity, temperature and moisture would give information concerning (1) the influence of condensation and evaporation on the temperature and velocity field, (2) the exchange coefficients characteristic for the self-turbulence of the plume, and (3) deliver integral data (length of the fog plume, asymptotic height) to check the results of calculations. The adiabatic temperature decrease of the plume during the rise caused by the atmospheric pressure gradient cannot be simulated in small-scale experiments. In the second part of the report it is investigated by means of a simple theoretical model which cooling tower and atmospheric parameters determine mainly the rise and the diffusion of cooling tower plumes. These are the initial moisture of the cooling tower air, the distribution of moisture and temperature in the atmosphere and the wind velocity, which was not taken into account in the theoretical model. Therefore in the experiments there should be the possibility to change these parameters within certain limits. Another interesting result of the calculations is that under certain conditions a second fog plume may occur in larger heights caused by the adiabatic temperature decrease. These phenomena, which cannot be simulated in small-scale experiments, are possible for wet as well as for dry cooling towers. (auth)

13435 (LA-UR-74-1429) DEVELOPMENT OF A SUPERCONDUCTING SWITCH FOR MAGNETIC ENERGY STORAGE SYSTEMS. Lindsay, J. D. G.; Blevins, D. J.; Laquer, H. L.; Miranda, G. A.; Rogers, J. D.; Swannack, C. E.; Weldon, D. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 5p. (CONF-740957-2). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Some of the problems encountered in constructing superconducting switches for magnetic energy storage systems are discussed. Empirical rules are given which assure that a switch is driven fully normal when triggered, and some of the possible geometrical arrangements for switches are considered. Results of energy transfer experiments from 20 kJ and 300 kJ superconducting energy storage systems using superconducting switches are given. (auth)

13436 (LA-UR-74-1443) INVESTIGATIONS ON POTENTIAL CONDUCTORS FOR A DC SUPERCONDUCTING POWER TRANSMISSION LINE IN A 20 METER TEST BED. Hoffer, J. K. (Los Alamos Scientific Lab., N. Mex. (USA)). 30 Sep 1974. Contract W-7405-eng-36. 5p. (CONF-740957-14). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The cryogenic and electrical aspects of a program to evaluate superconductors for a dc superconducting power transmission line are presented. Results for conductors in lengths of 20 meters operated at currents up to 10 kA are described. A battery driven power supply which is capable of delivering and controlling currents up to 50 kA is discussed. Specific experiments are discussed which have been designed to probe the response of the conductors to a variety of thermal and electrical conditions, such as: thermal gradients over the length of the conductor, single and two phase flow of cryogen, loss of coolant flow, operation at temperatures near T_c, a.c. ripple current, and high current ramping rates. (auth)

13437 (LA-UR-74-1459) FUNDAMENTAL ASPECTS OF SYSTEMS FOR THE THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER. Bowman, M. G. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 11p. (CONF-741032-2). Dep. NTIS $4.00.

From 1st national topical meeting on nuclear process heat applications; Los Alamos, New Mexico, USA (1 Oct 1974).

It is clear that hydrogen will become increasingly important as a medium for energy storage, energy transmission and for use as a non-polluting fuel. In the long run, the production of hydrogen from fossil fuels must be supplanted by large volume production from alternate energy sources. The inherent high efficiency possible for the thermochemical production of hydrogen by direct use of primary heat is strong motivation for research to develop optimized processes. Maximum efficiency will be realized only if the thermochemical cycle is optimized for the temperature of the heat source. This implies that each heat source will require a different process. In order to conduct a systematic program of selecting useful processes from the very large number potentially available, it will be advantageous to delineate the thermodynamic, kinetic, engineering and economic criteria required for an optimum process and then conduct a vigorous theoretical and experimental program

to identify cycles that approximate these criteria. This paper demonstrates one method of applying thermodynamic criteria in the synthesis of thermochemical processes for water splitting. (auth)

13438 (SAND-74-0113) FLYWHEEL ENERGY SYSTEMS. Biggs, F. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 46p. Dep. NTIS $4.00.

Concepts are developed for advanced flywheels made of high-strength filamentary composite materials. The various flywheel systems described are important to the clean and efficient use of energy. Recent related work is summarized and several relevant research areas are identified. (auth)

13439 (SAND-74-0295) SIZING OF FOCUSED SOLAR COLLECTOR FIELDS WITH SPECIFIED COLLECTOR TUBE INLET TEMPERATURE. Lee, D. O.; Schimmel, W. P. Jr.; Abbin, J. P. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 45p. Dep. NTIS $5.25.

An axial temperature differential analysis has been used to size the collector field required to power a 40-kW (electrical) load. The number of north-south-oriented collectors required to furnish the desired energy and temperature rise in the collector fluid is determined by the requirements of several typical organic working fluid Rankine-cycle energy conversion systems. Calculations based on heliostatically mounted collector systems and fixed-tilt east-west tracking collector systems are presented. The collector matrix sizes obtained by these calculations are somewhat optimistic because the effects of wind losses and shadowing by adjacent collectors are not considered. In addition, no losses are considered for connections between collectors. However, losses in the Rankine-cycle power conversion loop are considered. This analysis is thus valid for a lossless, "infinitely" spaced collector field. (auth)

13440 (UCID-3678) COLLECTION OF ENERGY COURSES DESIGNED BY PARTICIPANTS OF THE ENERGY INSTITUTE FOR COLLEGE TEACHERS, SUMMER 1974. Shinners, C. W. (ed.). (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 235p. Dep. NTIS $14.75.

In the summer of 1974 the Energy and Environment Division of the Lawrence Berkeley Laboratory conducted a five week institute on energy for college teachers. The first aim of the institute was to provide the teachers with a solid starting-off point from which they could move, on their own, toward a more complete knowledge and understanding of energy matters and, ultimately, to begin teaching their own energy related courses. This was achieved by a series of morning lectures by experts in the field. The second purpose was to stimulate teachers into developing their own course and curricular materials and, in afternoon sharing sessions, to exchange thoughts and ideas on how to teach such courses. A collection of materials is given that represents the output from the afternoon sessions. (SFL)

13441 (UCRL-51686) LIQUID PLUGGING IN IN SITU COAL GASIFICATION PROCESSES. Gregg, D. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1974. Contract W-7405-eng-48. 7p. Dep. NTIS $4.00.

The presence of liquids can severely alter the spacial propagation characteristics of the flame front in an in situ coal gasification process. In a cocurrent burn, the liquids, water, and coal tars will be baked or pyrolyzed out of the coal in the hot zone near the flame front and will condense on cooler coal further downstream from the flame front. In the region where condensation is taking place, the liquids can plug the formation and thus alter or stop the gas flow pattern necessary for maintaining a spacially controlled flame front. Liquid plugging effects and their relationship to the permeability and the absolute crack sizes in the formation are discussed in a semiquantitative manner. The calculations presented are a rough guide to the requirements for preparing the coal seam with hydraulic or explosive fracturing, when such fracturing is needed. (auth)

Information Handling

13442 (AERE-M-2656) PREPARATION OF INTERDISCIPLINARY CURRENT AWARENESS BULLETIN FROM SEVERAL TAPE SERVICES: PRELIMINARY STUDY. Terry, J. E.; Olive, G. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Oct 1974. 15p. Dep. NTIS (US Sales Only) $4.00.

A preliminary study was undertaken of the production of a current awareness bulletin in an interdisciplinary subject, corrosion, by computer selection from several tape services. The literature of the subject and the coverage of the tape services were examined. The references obtained by computer matching a profile for corrosion against titles in ten different tapes for six months were analyzed. Duplication between two of the services was studied as a function of time. The results of the preliminary study showed that it would be expensive to produce a bulletin by such means and the delay in notifying many of the references would be considerable, so the project was not continued to a full-scale study. Nevertheless, the data collected, although particularly relevant to the subject of corrosion, should be of interest to anyone planning to merge computer selections from several different tape services. (auth)

13443 (DHEW/FDA-75-8006) REPORT OF STATE AND LOCAL RADIOLOGICAL HEALTH PROGRAMS. Fiscal Year 1973. Miller, L. A. (Bureau of Radiological Health, Rockville, Md. (USA)). Jul 1974. 88p.

The resources and activities of 53 State and local radiological health programs in the USA are presented and summarized from data collected as of June 30, 1973. Resources include data on personnel, funds, and equipment. The program activity areas are basic planning and administration, x-ray survey and control, environmental surveillance, radioactive materials, electronic products, and other radiological health activities. (auth)

13444 (MLM-2189(OP)) CASE STUDY: MANUFACTURING DATA BASE STRUCTURES. Depew, E.; Gondert, J.; Karcher, L. (Mound Lab., Miamisburg, Ohio (USA)). 7 Nov 1974. Contract AT-33-1-GEN-53. 35p. Dep. NTIS $4.75.

The use of the COPICS system as a physical data base design guide at Mound Laboratory is described. The way in which the data bases can be extended and redefined by logical views and user integration problems are discussed. The application established four physical data bases: warehouse, vendor, current purchase order, and purchase order history. (SFL)

13445 INIS: THE INTERNATIONAL NUCLEAR INFORMATION SYSTEM. Middleton, M. Aust. Libr. J.; 23: No. 4, 136-140(May 1974).

A description is given of the formation and development of the International Nuclear Information System. Reference is made to Australia's involvement in the system, especially documentation coverage and input/output procedures for INIS magnetic tapes. (auth)

13446 (UCCND-CSD-INF-14) LISTING OF ORCHIS DATA BASES. Slusher, R.; Brooks, A. A. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 55p. Dep. NTIS $5.75.

A listing and indices are presented to the several data bases that have been processed by the ORCHIS system and documented with the Computing Applications Department by the user. It is expected that the report will: (a) make the existence of the data bases known to potential UCC-ND users and (b) prompt other data base holders to submit documentation of their data bases for inclusion in future listings. A current version of this data is mounted on-line for searching with ORLOOK. (MCW)

Law

Refer also to abstracts 11551–11553, 13053, and 13449.

13447 APPOINTMENT AS EXPERT IN RADIATION PROTECTION ACCORDING TO PARAGRAPH 4 PAR. 1 PHRASE 1 AND PARAGRAPH 8 PAR. 1 NO. 1a OF THE X-RAY ORDINANCE. Decree of the Hess. Sozialmin., as of May 2nd, 1974. Arbeitsschutz (Cologne); No. 7, 218(Jul 1974). (In German).

The text of the authorization appointing an expert in the field of radiation protection is presented. (GE)

13448 REGULATIONS CONCERNING THE STATE NUCLEAR INSPECTORATE'S ORGANIZATION AND ACTIVITIES. Norsk Lovtidend; No. 5, 199-201(5 Mar 1973). (In Norwegian).

Instructions are given for the constitution, meetings, activities and responsibilities for the Board and Secretariat of the State Nuclear Inspectorate. (NO)

Management

Refer also to abstract 11639.

13449 (AED-CONF-74-221-005) AUTHORIZED PHYSICIAN: EDUCATION AND PROFESSIONAL REQUIREMENTS. Raschke, G. (Landesinstitut fuer Arbeitsmedizin, Berlin (F. R. Germany)). 1974. 8p. (In German). INIS.

From 15th annual meeting on the authorized physician within the meaning of the radiation protection laws; Karlsruhe, Germany (14 Jun 1974).

According to paragraph 46 of the First Radiation Protection Ordinance, and paragraph 42 of the new X-Ray Ordinance, the medical examination of persons occupationally exposed to ionizing radiation shall be only by physicians authorized by the appropriate

authorities. Only those physicians shall be authorized who successfully attended a main course in radiation protection. The teaching program for such courses, held at the Academy for Industrial Medicine in West-Berlin, is explained in the paper. (GE)

13450 (EUR-5011) EUROPEAN COMMUNITY FOR ATOMIC ENERGY SECOND PROGRAMME. (Commission of the European Communities, Brussels (Belgium)). 1 Jul 1972. 323p. (In French). INIS.

The second indicative nuclear program established in 1972, the objectives, the means of realizing them, and the long-range prospects are described. The activities and developments of EURATOM with respect to radioprotection are reported. The probable evolution of the production of the electric sector is outlined. The present status of light water reactors is summarized and the predictions of the construction of this type reactor up to 1984 are made. The fuel cycle is discussed. Fast reactors and the development of high temperature reactors are considered. (INIS)

13451 (LBL-3089) LBL-MIS: A COMPUTER AIDED SYSTEM FOR MANAGEMENT OF RESEARCH. Hinckley, R. L.; Kane, D. F.; Kearney-Wright, J.; Weber, P. W.; Zimmerman, J. L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 50p. Dep. NTIS $5.45.

An experimental, computer-oriented management information system, LBL-MIS, currently under development is designed to aid the management primarily of the Physics Division, but potentially to aid other LBL divisions also. The historical background to this system is included in Appendix A. The approach taken was to integrate the many pieces of available machine-readable management data and to heuristically approach a general management system, using the high speed CRT display as a basic I/O device. (MCW)

13452 (WASH-1190(1972)) NATIONAL SURVEY OF COMPENSATION PAID SCIENTISTS AND ENGINEERS ENGAGED IN RESEARCH AND DEVELOPMENT ACTIVITIES, 1972. (Battelle Columbus Labs., Ohio (USA)). 1 Nov 1972. 288p. Dep. NTIS $17.50, GPO $3.50.

In November of 1966, the Atomic Energy Commission awarded a contract to the Columbus Laboratories of Battelle to design a survey of compensation paid to scientific and engineering personnel engaged in research and development in the United States. The contract provided that such a survey would utilize the maturity or "age-wage" approach, under which salary data would be related to years since receipt of degree or chronological age. Results are reported of the fifth annual survey, conducted in 1972. This survey was funded by the Atomic Energy Commission. The sampling plan involved the development of a sampling frame of establishments employing scientists and engineers engaged in research and development. Separate sampling frames were developed for five types of establishments (sectors). The sampling plan incorporated stratification by sector, number of scientists and engineers in the Standard Metropolitan Statistical Areas, and size of establishments. The universe of scientists and engineers engaged in research and development activities was divided into the following five sectors for sampling purposes: Industry, Nonprofit Research Institutes, Federally Funded Contract R & D Centers (referred to as Contract Research Centers), Federal Government, and Educational Institutions. (auth)

Mathematics and Computers

Refer also to abstract 13515.

13453 (AERE-R-7119) TWO FORTRAN SUBROUTINES FOR DIRECT SOLUTION OF LINEAR EQUATIONS WHOSE MATRIX IS SPARSE, SYMMETRIC AND POSITIVE-DEFINITE. Reid, J. K. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Jun 1972. 34p. Dep. NTIS (US Sales Only) $4.75. UK £1.00.

Two subroutines for solving systems of linear equations whose matrix is sparse, symmetric, and positive-definite are presented. Each uses symmetric triangular decomposition. One ignores sparsity within a variable band-width format and performs no interchanges. The other uses list processing to enable only non-zeros to be stored and chooses interchanges to avoid fill-in of zeros. The advantages of each are explained. (auth)

13454 (AERE-R-7833) HARWELL TSO COMMAND LANGUAGE EXTENSION. Greenleaf, J. R. (comp.). (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Oct 1974. 136p. Dep. NTIS (US Sales Only) $10.00. UK £2.50.

A description of additional commands that were made available on the IBM Time Sharing Option terminal system installed on the Harwell central computer is presented. Details are given, for each command, of function and syntax with examples of use. The supplement should be used in addition to and in conjunction with the publication IBM System/370 Operating System: Time Sharing Option, Command Language Reference. (MCW)

13455 (ANCR-1183) MIMSY: MULTITASK INTERPRETIVE MATHEMATICS SOFTWARE FOR PDP-15 COMPUTERS. Myers, W. R. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Nov 1974. Contract AT(10-1)-1375. 39p. Dep. NTIS $4.00.

MIMSY is an extensive, completely re-entrant floating point software package for PDP-15 computers equipped with API and EAE. Space requirements are approximately 800 words for the arithmetic operations, 460 additional locations for the input and output controllers, 550 locations for the common functions, and 470 locations for symmetric matrix arithmetic. A 32-word scratch area is required in each application module. The package is interpretive and requires only one-word instructions, except for the "enter" operation that requires two words to establish the user scratch area. Normal PDP-15 addressing conventions are followed, allowing operation in up to 32K words of memory. The interpreter may be easily adapted to a variety of operating systems by modification of the short (bookkeeping) prologue. (auth)

13456 (BNL-18803) SECOND ANNUAL AEC SCIENTIFIC COMPUTER INFORMATION EXCHANGE MEETING. Proceedings of the Technical Program Theme: Computer Graphics, May 2–3, 1974, New York City. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 322p. (CONF-740512-). Dep. NTIS $19.25.

From 2nd AEC scientific computer information exchange meeting; New York, New York, USA (2 May 1974).

The topic of computer graphics serves well to illustrate that AEC affiliated scientific computing installations are well represented in the forefront of computing science activities. Session I, entitled Advanced Systems, contains five presentations describing systems that contain features not generally found in graphics facilities. These features can be roughly classified as extensions of standard two-dimensional monochromatic imaging to higher dimensions including color and time as well as multidimensional metrics. Session II presents seven diverse applications ranging from high energy physics to medicine. Session III describes nine important developments in establishing facilities, techniques, and enhancements in the computer graphics area. (auth)

13457 (CEA-R-4547) STUDY OF RECURSIVE DIGITAL FILTERING IN TIME DOMAIN. Application to Matched Filters Synthesis. Chaudourne, S. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Nov 1974. 92p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

In a first part, digital filters are defined as linear operators commutative with translations in the Hilbert space BL^2. Then Recursive Digital Filters are introduced as a subset corresponding to digital filters described by a difference equation satisfying to some conditions. The second part is devoted to the description of a method for computing coefficients of a recursive digital filter from a pattern in the time-domain. Different variants are studied and their results are compared. The last part is an investigation of problems regarding technological realization of recursive digital filters, particularly the question of stability. A design of programmable recursive digital filter is given; performances of this design are tested in a simulation of a detection problem by matched filtering. (auth)

13458 (CEA-R-4611) NUMERICAL INTEGRATION METHODS IN FINITE ELEMENTS. Leiterer, R. (CEA Centre d'Etudes de Limeil, 94–Villeneuve-Saint-Georges (France)). Nov 1974. 36p. (In French). Dep. NTIS (US Sales Only) $5.25.

A comparison is made of some direct integration methods to compute the dynamic response of structural systems. These methods are: collocation, weighted residual, Galerkin's weighted residual, θ and β methods. Order and stability are studied. Some numerical results are presented for the wave equation and an application is given for the calculation of stresses inside infinite cylinders submitted to a pulse pressure force. (auth)

13459 (CERN-74-24) PL-11: A PROGRAMMING LANGUAGE FOR THE DEC PDP-11 COMPUTER. Russell, R. D. (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Dec 1974. 116p. Dep. NTIS (US Sales Only) $9.00.

The manual gives the specification for a new programming language, PL-11, which is a high-level assembler for the DEC PDP-11 computer. The language has been modelled after PL-360. It is block structured, in a similar way to ALGOL-60, and gives access to all the PDP-11 hardware facilities, with the possibility of specify-

ing for which model and hardware options the compiler will generate code. It also has facilities for CAMAC programming. PL-11 serves as the standard programming language on PDP-11s in CERN's Omega Project, a multiparticle spectrometer whose data acquisition system consists of a number of PDP-11s on-line to a CII 10070. (auth)

13460 (CONF-741118-1) SYNTAX-DIRECTED FORTRAN PREPROCESSOR AND FORMATTING SYSTEM. Boyle, J. M.; Dritz, K. W. (Argonne National Lab., Ill. (USA)). [nd]. 2p. Dep. NTIS $4.00.

From workshop on FORTRAN preprocessor for numerical software; Pasadena, California, USA (7 Nov 1974).

The system under development is a tool to assist numerical analysts preparing quality mathematical software, for example, in the NATS II project. It is primarily applicable to the problem of adapting collections of FORTRAN routines to a variety of different computers; other applications made possible by its use of syntax-directed methods include program formatting to satisfy editorial or documentation standards and translation to standard FORTRAN or to a structured variant of FORTRAN. Central to the system is the idea of representing FORTRAN routines (even storage) in an abstract form. (MCW)

13461 (EFI-35(73)) VT05 DISPLAY AS A REMOTE TERMINAL TO PDP-9 COMPUTER. Dadyan, A. T. (Erevanskij Fizicheskij Inst. (USSR)). 1973. 7p. (In Russian). INIS.

The technical realization of the use of the VT05 as a remote terminal to the PDP-9 computer is described. (tr-auth)

13462 (IAE-2302) PROGRAM OF KINETIC EQUATION SOLUTION FOR SPHERIC SYMMETRIC REGION IN A P_1-APPROXIMATION. Konyaev, S. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1973. 28p. (In Russian). INIS.

The characteristics of the PIR-2 program are given. The setting up of the problem and the method for its numerical solution are described. The preparation of the input and output data is reported. Some examples of input and output data are given. Numerical calculations of some model programs on the computer illustrate the operation of this program. (tr-auth)

13463 (IFA-MC-20-1974) PROGRAM USED FOR THE IBM/370-135 OF THE INSTITUTE OF ATOMIC PHYSICS. Radulescu, T. G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 10p. (In Rumanian). Dep. NTIS (US Sales Only) $4.00.

Three programs used in the IBM/370-135 at the Institute for Atomic Physics are presented. (JSR)

13464 (IFVE-SVM-73-65) SCANNERS OF COMPUTERS AND PERIPHERALS FOR COLLECTIVE USING FOR HANDLING SYSTEM OF THE IHEP PHYSICAL INFORMATION. Zhil'chenkov, V. D.; Matveev, V. D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1973. 29p. (In Russian). INIS.

The general principles for the construction of the communication apparatus for the linking of the M-220, BESM-4, and Minsk-22 computers with collective use installations are discussed. The structure of the service exchange code is discussed in detail and the logics of three types of communication channels are examined briefly. The time characteristics of the communicator and exchange between subscribers are given for different exchange regimes. (tr-auth)

13465 (JINR-P11-8059) DETERMINATION OF THE PARAMETERS OF THE MAGNETIC SYSTEMS FOR PRODUCTION OF HOMOGENEOUS FIELDS USING A COMPUTER. Aleksandrov, L.; Zhidkov, E. P.; Zinov'eva, L. L. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 25p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The general approach to the determination of the parameters of the magnetic systems for creation of a homogeneous field is examined. The mathematical problem is reduced to an overdetermined nonlinear system of equations which are solved by means of regularized iteration processes of the Gauss-Newton type. A numerical study of the effect of different factors on the homogeneity of the field was made on the example of a specific magnetic system. (tr-auth)

13466 (KFK-PDV-26) CONTROL ALGORITHMS FOR IMPLEMENTATION ON PROCESS CONTROL COMPUTERS. Unbehauen, H.; Boettiger, F. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). Sep 1974. 115p. (In German). Dep. NTIS (US Sales Only) $8.75.

A survey about the control schemes for one-dimensional controlled systems that are especially suitable for use with direct digital control is presented. First of all, continuous controllers are designed, concentrating on the PID-algorithm in its different forms and modifications. Furthermore, algorithms designed on the basis of the compensation of the controlled system in discrete representation, are considered. The best known algorithm of this class is the deadbeat response algorithm, which can be designed in the frequency range as well as in the time range. Further classes of algorithms are those with preset structure, which are optimized according to a criterion, special controllers for stochastically disturbed systems as well as nonlinear algorithms. (tr-auth)

13467 (KFK-PDV-27) PROBLEMS OF COMMUNICATION AND DATA ACQUISITION IN COMPUTER-CONTROLLED PRODUCTION SYSTEMS. Baeck, U. (Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (F. R. Germany)). Oct 1974. 51p. (In German). Dep. NTIS (US Sales Only) $5.75.

Acquisition of operating data, particularly in computer-controlled equipment, forms the basis for improvement and monitoring of the production sequence as well as the basis for control and optimization of the production process. This report deals with the problems of on-line data acquisition and with communication between man and acquisition system. An acquisition plan will be presented in which the minicomputer, connected to one of the production computers, will be employed as a central data acquisition point as well as for data concentration. (tr-auth)

13468 (KFKI-74-74) PARALLEL-SERIAL TELEPRINTER CODE CONVERTER OF THE MINICOMPUTER TPA-70. Pal, S. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Oct 1973. 11p. (In Hungarian). Dep. NTIS (US Sales Only) $4.00.

The circuit described is an 8 bit parallel, 11 bit serial teleprinter code converter built with TTL ICs, employing the shift-register conversion technique for controlling typewriters (e.g. Teletype Mod. 33) utilizing 8-level teleprinter code. (tr-auth)

13469 (LA-UR-74-1693) THREE-DIMENSIONAL MESH GENERATOR FOR FINITE ELEMENT COMPUTER CODES. Cook, W. A. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. 8p. (CONF-741001-31). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

A method is discussed for generating geometric data (nodal points) and continuum regions data (elements) for finite element computer codes. The detailed portions discussed are: space curve generator for locating nodal points along geometric and material edges; surface generator for nodal points along geometric and material surfaces; three-dimensional volume generator for interior nodal points; and the ability to combine separately generated meshes into a master mesh for complex geometries. The criterion used for building these generators is to be able to group nodal points according to the anticipated field variable gradients. (auth)

13470 (LBL-2692) I. UNIFIED APPROACH TO UNCONSTRAINED MINIMIZATION. II. Generation of Conjugate Directions for Unconstrained Minimization Without Derivatives. Nazareth, L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1973. Contract W-7405-eng-48. 144p. Dep. NTIS $10.25.

Thesis.

Several important classes of algorithms for unconstrained minimization, when applied to a quadratic function with Hessian A, may be regarded as being alternative ways to effect certain matrix factorizations of or with respect to A. This approach leads to a clear insight into the basic equivalence of many algorithms that are implemented in very different ways and which differ in their informational requirements. It also enables their presentation within a unified framework. For the case when the Hessian is directly available, an algorithm that effects a particular decomposition of the Hessian is discussed in detail. Another important class of algorithms that corresponds to alternative ways of effecting the QR (or Gram-Schmidt) factorization is discussed. The development and analysis of a particular technique for generating conjugate search directions for unconstrained minimization without derivatives are considered. (MCW)

13471 (RISO-M-1708) PROVING CORRECTNESS FOR A REAL TIME OPERATING SYSTEM. Taylor, J. R. (Danish Atomic Energy Commission, Risoe. Research Establishment). Aug 1974. 17p. (CONF-740355-1). Dep. NTIS (US Sales Only) $4.00.

From IFAC-IFIP workshop on real time programming; Budapest, Hungary (25 Mar 1974).

Proof techniques for program correctness have earlier been demonstrated for programs of moderate size and complexity. In this paper, the techniques are extended to real time programs, and are used to prove some correctness results for a specially constructed operating system kernel. (auth)

13472 (SAND-74-5538) VIDICON DIGITIZER USES COMPUTER FOR CALIBRATION AND CONTROL. Harstad, D. N.

(Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 6p. CONF-741107-1). Dep NTIS $4.00.

From DECUS symposium; San Diego, California, USA (5 Nov 1974).

A Digital Equipment Corporation PDP-11 is used with a vidicon digitizer developed at Sandia Laboratories. The digitizer consists of a silicon diode array vidicon tube mounted in a TV camera, oscilloscope, mirror, beam splitter, logic chassis and display unit. The vidicon beam makes 500 sweeps per scan. A digital value (0-512) based on amplitude is assigned to each sweep (sample number). The computer is used to control and calibrate the digitizer and also to store, manipulate and output, in engineering units, data generated by the digitizer which is in the form of data counts for each sample number (1-500). The purpose of the calibration is to remove any time or voltage nonlinearities which may exist in the digitizer. The calibration consists of calculating volts per count scale factors for each of 56 regions that the oscilloscope has been divided into. Calibration also includes calculating and storing the times of zero crossings which occur when ten cycles of a square wave (which is symmetric around zero volts) are digitized. (auth)

13473 (SAND-74-8215) GAS-TRANSFER ANALYSIS, SECTION E: UNCHOKED DISCHARGE SOLUTIONS. Chenoweth, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 28p. Dep. NTIS $4.50.

The exact subsonic discharging solutions (infinite receiver volume) are derived in terms of the minimum flow area "Mach number" for both adiabatic and isothermal reservoirs. The solutions are valid for an ideal gas and unity loss coefficient but arbitrary time-dependent product of discharge coefficient and minimum flow area, C_dA_e. The solutions are different mathematically for diatomic and monatomic gases as well as for the initially choked and initially unchoked gases. The choked flow solutions from Section B are coupled to these results and are included for completeness. Extensive results are presented for constant C_dA_e where it is shown that all possible discharge solutions can be presented in non-dimensional form with only a few graphs. Also it is shown that simple expressions for the time of pressure equilibrium exist in terms of a reference time scale, the ratio of specific heats, and the initial receiver to supply pressure ratio. (auth)

13474 (SC-M-70-26) SEVER: A ROUTINE FOR COMPUTING SYMMETRIC MATRIX EIGENVALUES AND EIGENVECTORS WITH ERROR BOUNDS. Gavin, W. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Mar 1970. 58p. Dep. NTIS $6.25.

Subroutine SEVER computes a complete eigensystem with error bounds for a real symmetric matrix. Householder's method is used to reduce the matrix to tridiagonal form. The eigenvalues and eigenvectors of the tridiagnonal matrix are computed by the QR algorithm. The computed eigenvalues are subjected to one Rayleigh quotient correction using the computed eigenvectors. Upper bounds on the absolute errors of the computed eigensystem are calculated. (auth)

13475 (UCID-30097) STRUCTURAL-ANALYSIS MOVIE POSTPROCESSOR (SAMPP) USERS MANUAL. Brown, B. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1974. Contract W-7405-eng-48. 38p. Dep. NTIS $5.00.

SAMPP is a general routine for the display of three-dimensional, finite element models and the results of both static and dynamic analyses. The postprocessor may be used to produce line drawings and continuous tone pictures, as well as animated-line-drawing movie sequences. The SAMPP uses a hidden-surface processor for the display of realistic perspective views. SAMPP is written in Fortran and is compiled, loaded, and run on the CDC 7600 computers of the Livermore time-sharing system. (auth)

13476 (UCRL-51654) PHYSICAL EXPLANATION OF ELECTROMAGNETIC SURFACE WAVE FORMULAS. Lytle, R. J.; Miller, E. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Oct 1974. Contract W-7405-Eng-48. 16p. Dep. NTIS $4.00.

The behavior of electromagnetic surface waves generated by both elevated and buried sources is explained by physical reasoning, with mathematical formulas describing the physical processes. All combinations of source and receiver orientations are considered. Applications of generalized surface wave formulas for mixed-path and spatially-varying terrains are discussed. The generalized surface wave formulas for buried sources are validated by evaluation of Sommerfeld integrals. These formulas are applicable over a wider range than previous approximate surface wave formulas. (auth)

13477 (UCRL-51655) CRACKED TWO-DIMENSIONAL SYSTEMS. Cook, R. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Oct 1974. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

The computer code CRACK calculates the free energy and the energy and displacement fields of a two-dimensional, triangular lattice connected by nearest-neighbor Hookean springs. Certain of the bonds may be broken to approximate a crack, and an external force can be applied to the boundaries parallel to the crack. (auth)

13478 (UCRL-75671) SYSTEM APPROACH FOR PROCESSOR IMPLEMENTATION. Fisher, E. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Oct 1974. 20p. (CONF-741047-1). Dep. NTIS $4.00.

From meeting of the Swiss Federal Institute of Technology; Lausanne, Switzerland (14 Oct 1974).

The primary design criterion of the microprocessor system developed was to provide a complex logic function that could be used in system designs without necessitating the redesign of each microcomputer for each system. The result was a three-card modular computer compatible with an existing logic line previously used on minicomputer interfacing. The partitioning has the following features: three-card minimum system; modular memory in 256, or 1-K word blocks; no limit of m[illegible]oprocessor capabilities; no modification of the microprocessor bus configuration; hardware and power supplies shared with the application; interface; and simple interfacing. This implementation has been in use for the past three years with about 300 units in the field. As a result, a large number of I/O devices were developed and some are shown. (MCW)

13479 (UCRL-76048) LLL APT IV IMPLEMENTATION. Gong, T. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1974. 10p. (CONF-741119-1). Dep. NTIS $4.00.

From computer aided manufacturing-International Inc. conference; Arlington, Texas, USA (11 Nov 1974).

The work is described that was performed by the LLL Automatic Programmed Tool (APT) system group to the Computer Aided Manufacturing-International, Inc. APT IV version A4V2. Emphasis is on how the system was made to run efficiently under the in-house Livermore Timesharing System on the CDC-7600 computer system. (auth)

13480 (UCRL-76124) CONTINGENCY PLANNING. Richards, M. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Oct 1974. 21p. (CONF-741041-2). Dep. NTIS $4.25.

From conference on atomic energy systems, operations, and programming focus on management issues; Bethesda, Maryland, USA (23 Oct 1974).

The LLL Octopus System contains unique hardware. Exact duplication at an alternate site is not economically feasible. Therefore, present contingency plans emphasize preventive measures and plans for alternate operating modes to cover short to medium term interruptions. Short interruptions in terms of minutes to hours and medium term interruptions in terms of hours to days are defined. A formal contingency plan to cover long term interruptions resulting from total disasters is almost non-existent. The system configuration and its relative physical location are described. The estimated cost of setting up and maintaining a total disaster contingency plan assuming offsite operations is presented. (MCW)

13481 (UCRL-76192) MICROS VERSUS MINIS IN A LABORATORY ENVIRONMENT. Fisher, E. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1974. 7p. (CONF-741001-32). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The decision to select a minicomputer or a microcomputer for laboratory experiments is a problem. Three examples where a microcomputer is used in automation applications are described. In each application, critical aspects that led to using a microcomputer are discussed. The applications include: uranium titration, automatic batch monitoring, and spectroscopy display. (MCG)

Miscellaneous

13482 (CONF-740948-1) FREEZING AND LOW-TEMPERATURE STORAGE OF LIVING CELLS. Mazur, P. (Oak Ridge National Lab., Tenn. (USA)). 1974. 26p. Dep. NTIS $4.50.

From UNESCO-ICLA-IRO workshop on basic aspects of freeze preservation of mouse strains; Bar Harbor, Maine, USA (16 Sep 1974).

Techniques used for the preservation of living animal cells by freezing and low-temperature storage are described. (CH)

13483 (CONF-741067-1) OCEANOGRAPHY OFF THE NORTH COAST OF PUERTO RICO. Kendall, T. R. (Puerto Rico Nuclear Center, Mayaguez). 1974. 13p. Dep. NTIS $4.00.

From eastern pacific oceanic conference; Lake Arrowhead, California, USA (2 Oct 1974).

Currents, tides, bathymetry, and hydrographic data were intensively measured off the North Coast of Puerto Rico during January–June 1974. Results indicate a strong tidal dominance on flow, essentially parallel to the coast, with peak tidal velocities of around 30 cm/sec, alternately westward and eastward. Average net alongshore flow was found to be 3 cm/sec westward. (MCW)

13484 (INIS-mf-1551) INSTITUTT FOR ATOMENERGI 25 YEARS OLD. Eriksen, V. O. (Norsk Atomenergiforening, Oslo). 1974. 39–57p. (In Norwegian). INIS.

Following a brief outline of the history of Institutt for Atomenergi, and summary of its functions, the work of the institute in its main fields is briefly described. These include fuel development, safety technology, underground siting, prestressed concrete pressure vessels and waste treatment. Rather longer discussions of projects in process control, isotope technology, rare earth production and neutron physics are given. Finally views are presented on the current nuclear controversy. (INIS)

13485 (JINR-E2-8089) MINIMAL CANONICAL REALIZATIONS OF THE LIE ALGEBRA $O_c(n)$. Havlicek, M.; Exner, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 38p. Dep. NTIS (US Sales Only) $5.00.

For the complexification of the Lie algebra of the orthogonal group in n-dimensional space it is shown that its canonical realization by means of polynomials in N pairs of canonical variables does not exist if $N < n-3$. As canonical realization by means of $N = n-2$ pairs exist, the problem of minimal canonical realization for $O_c(n)$ is, in the general case, reduced to two possibilities only. For $n < 7$, this problem is solved completely. It is further shown that, with some exceptions, the Casimir operators in canonical realization by means of n-2 pairs of canonical variables are realized as multiples of the identity element and that among them there is only one independent. If particularly canonical realization by means of n-3 pairs exists then the values of all Casimir operators are even fixed by n. (auth)

13486 (NP-20211) ANNUAL REPORT, 1972. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). 31 Mar 1973. 42p. (In French). Dep. NTIS (US Sales Only) $5.25.

The progress made with respect to the development of sodium-cooled fast reactors, gas-cooled fast reactors, thermal reactors, basic research, health protection and safety, actinium program, and the BR2 reactor and its auxiliary installations are briefly indicated. The mission of the CEN and its financial structure are also considered. (JSR)

Chemistry

13487 (CONF-741125-1) CENTRIFUGAL ELUTION CHROMATOGRAPHY WITH ELUATE MONITORING. Scott, C. D.; Pitt, W. W. Jr.; Johnson, W. F. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 18p. Dep. NTIS $4.00.

From 9th international symposium–advances in chromatography; Houston, Texas, USA (4 Nov 1974).

The feasibility of using centrifugal, multicolumn, elution chromatography in conjunction with eluate monitoring is being studied. A preliminary prototype system has as many as four columns mounted in a spinning rotor that passes through a stationary photometric detection station. Cuvet windows at the terminal end of each chromatographic column allow photometric monitoring of each column eluate as it passes through the detector. The monitor is capable of associating a given output signal with the appropriate chromatographic column using suitable digital logic. The photometric output can be recorded by a conventional strip-chart recorder or, via a computer by printed tabulations. In the present mode of operation a common sample is introduced simultaneously to each column, with a single eluent stream being used for all columns. Preliminary tests were directed toward establishing the best rotor design for hydrodynamic stability and overall operability. The system is being considered for the assay of several serum proteins from a single serum sample utilizing affinity chromatography. (auth)

13488 (CONF-741134-1) ABSORPTION SPECTRA AND PHOTOLYSIS OF LOW TEMPERATURE Hg-HYDROCARBON MATRICES. Jones, T.; Moser, H. C. (Kansas State Univ., Manhattan (USA). Dept. of Chemistry). [nd]. Contract AT(11-1)-584. 11p. Dep. NTIS $4.00.

From 10th midwest regional meeting American Chemical Society; Iowa City, Iowa, USA (7 Nov 1974).

Absorption spectra and photoexcited reactions of Hg-hydrocarbon matrices were studied at 24 to 77°K. In studying the effect of matrix parameters on the observed spectra, the effect of temperature changes in Hg-methane, -ethane, and -n butane matrices is shown. At no point in the temperature experiments were the effects caused by temperature increase reversible. IR and vis-uv scans after photolysis revealed no new absorption bands attributable to low temperature matrix stabilized energy transfer intermediates. To determine which, if any, of the spectral features arose from contaminants in the matrix, air was codeposited along with Hg and n-butane. Only the absorption at 2675 Å appeared to be related to air impurity. UV absorption data of Hg-alkane matrices were compared with molecules of methane, ethane, propane, n-butane, iso-butane, and hexane. (MCW)

13489 (JAERI-M-5538) PHASE EQUILIBRIUM IN THE ETHYLENE-t-BUTYL ALCOHOL–WATER TERNARY SYSTEM UNDER PRESSURE. Watanabe, H.; Maruyama, S.; Yagi, T.; Hashiba, H.; Takehisa, M. (Japan Atomic Energy Research Inst., Tokyo). Jan 1974. 20p. (In Japanese). INIS.

Phase equilibrium in the ethylene–t-butyl alcohol–water ternary system and densities of gas phase and liquid phase at equilibrium were measured under pressure by using a tube-type apparatus and a tank-type apparatus. Phase equilibrium diagrams composed of homogeneous and heterogeneous regions and tie-lines in the heterogeneous region were determined in the pressure range of 60 to 400 kg/cm^{2}G and in the temperature range of 30 to 75°C. Pressure and temperature have no effect on the mutual solubility curve and have slight effect on the tie-line under the conditions. The experimental equation determining the density of gas phase was obtained as follows: $\rho = \Sigma_{n=1}^{3} \rho_n \cdot X_n - 0.28\ (\Sigma_{n=1}^{3} \rho_n \cdot X_n - \rho_1)\ X_1$ where ρ, density of gas phase; X, weight fraction of each component in gas phase; (1) ethylene, (2) t-butyl alcohol, (3) water. The density of liquid phase was about 1.0 g/cm^3 because it was composed of almost water. (auth)

13490 (LBL-3057) RECOVERY OF THE CELLULASE ENZYME SYSTEM OF TRICHODERMA VIRIDE BY ACETONE PRECIPITATION. Ige, R. T.; Wilke, C. R. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-eng-48. 112p. Dep. NTIS $8.75.

Thesis. Submitted by Richard T. Ige.

The recovery of cellulase from T. viride by acetone precipitation was studied to provide basic background information for possible recovery of cellulase in processes for enzymatic hydrolysis of cellulosic wastes. Effects of acetone concentration, temperature, and total soluble protein on the recovery of cellulase and the time required for the precipitate to reach equilibrium were examined. Stability and filtration characteristics of the cellulase precipitate were also studied. The results showed that more than 85% of the original enzyme activity can be recovered at temperatures as high as 35°C. Most of the cellulase activity is recovered with acetone concentration of 2.0 v/v or greater. Inactivation of the enzyme during precipitation with acetone exhibited first-order kinetics. Solubility of the cellulase protein was independent of temperature and could be described by the salting-out equation. Filtration studies indicated that the enzyme precipitate has a very large specific resistance. Addition of filter aid greatly improved the filtration rates. (auth)

13491 (LBL-3126) MECHANISM OF HYDROCARBON CATALYSIS ON PLATINUM CRYSTAL SURFACES. Somorjai, G. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 30p. (CONF-740953-1). Dep. NTIS $4.50.

From conference on physical basis for heterogeneous catalysis; Gstaad, Switzerland (2 Sep 1974).

The atomic structure of platinum crystal surfaces and the structure of adsorbed hydrocarbons by low-energy electron diffraction and the surface composition by Auger electron spectroscopy were studied. Catalytic reactions of low reaction probability (dehydrocyclization, dehydrogenation) were studied on one face of a single crystal of area less than 1 cm^2 by mass spectrometry at low pressures ($\approx 10^{-4}$ torr) and by gas chromatography at high pressures ($\approx 10^{-3}$ torr). The atomic structure of high Miller Index platinum surfaces is characterized by atomic height steps arranged periodically and separated by atomic terraces of low Miller Index orientation [(111) or (100)]. Experiments that compare the reactivity of crystal surfaces and supported platinum particles indicate that the atomic structure of polydispersed catalyst particles can be reproduced on these stepped crystal surfaces. The structure of adsorbed hydrocarbons were studied on both low and high Miller Index platinum surfaces. Atomic steps play a controlling role in dehydrogenating the hydrocarbon molecules and in dissociating hydrogen and other diatomic molecules of large binding energy. n-Heptane may undergo isomerization, hydrogenolysis and dehydrocyclization on the various platinum surfaces. The atomic structure of the stepped

crystal surfaces appear to control the product distribution for these competing reactions. (auth)

13492 (ORNL-TR-2863) ANODIC OXIDATION OF ACETIC ACID IN SULFURIC ACID SOLUTION. Schreiner, R. Translated by R. Gregg Mansfield from Z. Elektrochem.; 36: No. 12, 953-1040 (1930). 19p. Dep. NTIS $4.00.

The statement of Murray in 1892, that 10% (= 1.7 M) acetic acid in 10% sulfuric acid (= 2 N) undergoes practically no attack was disproved by the present study, and by means of the known oxidation path of acetic acid (and that of methyl alcohol), some rules were derived concerning the way in which these oxidations proceed. A diagram for anodic oxidation in sulfuric acid solution is shown and the rules are listed. (MCW)

13493 (TID-26553-P1) MASS SPECTRA OF COMPOUNDS OF BIOLOGICAL INTEREST. Volume I. Indices. Markey, S. P.; Urban, W. G.; Levine, S. P. (comps. and eds.). (Colorado Univ., Denver (USA). Dept. of Pediatrics). [nd]. 264p. Dep. NTIS $7.60.

A compilation of mass spectral data for biological compounds, primarily of endogenous physiological origin, is presented in two volumes, three parts. Volume I contains an alphabetical index listing page number, compound name, molecular weight, and identification number indicating the source of the spectrum. A second index in two parts is also included. The 14 AMU index deals with compounds with molecular weights less than 168; the 50 AMU index deals with compounds with molecular weights greater than 169. (JGB)

13494 (TID-26553-P2) MASS SPECTRA OF COMPOUNDS OF BIOLOGICAL INTEREST. Volume II., Part 1. Spectra. Markey, S. P.; Urban, W. G.; Levine, S. P. (comps. and eds.). (Colorado Univ., Denver (USA). Dept. of Pediatrics). [nd]. 484p. Dep. NTIS $10.60.

A compilation of mass spectral data for biological compounds, primarily those of endogenous physiological origin, is presented in two volumes. Volume I is devoted to the indices for Volume II. Volume II is made up of two parts, with the spectral data being ordered with respect to molecular weight of the compound. (JGB)

13495 (TID-26553-P3) MASS SPECTRA OF COMPOUNDS OF BIOLOGICAL INTEREST. Volume II., Part 2. Spectra. Markey, S. P.; Urban, W. G.; Levine, S. P. (comps. and eds.). (Colorado Univ., Denver (USA). Dept. of Pediatrics). [nd]. 484p. Dep. NTIS $10.60.

A compilation of mass spectral data for biological compounds, primarily those of endogenous physiological origin, is presented in two volumes. Volume I is devoted to the indices for Volume II. Volume II is made up of two parts, with the spectral data being ordered with respect to molecular weight of the compound. (JGB)

Life Sciences

13496 (BARC-708) SOLID STATE ELECTROMYOGRAPH TYPE OS 881. Part I. Functional and Clinical Aspects. Menon, V. K. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 25p. Dep. NTIS (US Sales Only) $4.25.

Basic requirements of an electromyograph (EMG) suitable for measurements of neuromuscular activity in patients are reviewed. A solid state electromyograph (EMG) was developed as a compromise between the facilities required and the cost, and its probable clinical applications are described. (auth)

13497 (BARC-764) ANNUAL REPORT FOR 1973 OF THE BIOORGANIC DIVISION. (Bhabha Atomic Research Centre, Bombay (India)). 1974. 129p. Dep. NTIS (US Sales Only) $9.50.

Brief summaries are presented of research studies in the field of organic chemistry during 1973. The biosynthesis of compounds having pharmaceutical properties in several plant species was investigated using ^{14}C-labeled precursors as tracers; studies related to plant propagation and culture were carried out using plant tissue cultures; the development of hormonal insecticides and insect repellants and chemosterilants by plants and the biosynthesis of prostaglandins were also investigated. Methods developed for microchemical and spectral analysis of organic compounds are reported. A list is included of 41 publications during the time period covered by this report. (CH)

13498 (BNWL-SA-5083) WATER UPTAKE BY COTTON ROOT SYSTEMS: AN EXAMINATION OF ASSUMPTIONS IN THE SINGLE ROOT MODEL. Taylor, H. M.; Klepper, B. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1974. 28p. (CONF-741121-1). Dep. NTIS $4.50.

From annual meeting of the American Agronomy Society; Chicago, Illinois, USA (10 Nov 1974).

In order to examine assumptions used in water uptake single root models, especially as they apply to field crops with a large rooting volume, an experiment was conducted on cotton plants. (CH)

13499 (CEA-CONF-2680) DISTRIBUTION OF ^{11}C-CHLORPROMAZINE IN MAN. Comar, D.; Maziere, M.; Raynaud, C. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot). 1974. 14p. (In French). (CONF-740120-4). Dep. NTIS (U. S. Sales Only) $4.00.

From 11th international symposium on radioactive isotopes in clinical medicine and research; Bad Gastein, Austria (8 Jan 1974).

Results are reported from a study on the metabolism of the psychotropic drug, chlorpromazine, in man. ^{11}C-chlorpromazine was used as a tracer to study tissue distribution. (CH)

13500 (CEA-R-4622) METHOD OF INVESTIGATION OF STOCHASTIC POINT PROCESSES. Application of a Digital Analysis Program to the Study of Unitary Activities and Action Potentials. Bassant, M. H.; Court, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Dec 1974. 90p. (In French). Dep. NTIS (US Sales Only) $7.50.

Within the frame of the methods of investigation of stochastic point processes, a program of digital analysis was developed in order to process all the time interval series. The full program written in Fortran IV is presented. It allowed, in particular, to study neuronal spikes of the dorsal hippocampus in the rabbit and to demonstrate characteristic patterns of cellular functions in response to electrical activity of the nerves. (FR)

13501 (CONF-740939-2) MONITORING AND CONTROL SYSTEM FOR THE AMINCO CELLTRIFUGE. West, C. D.; Willis, D. D. (Oak Ridge National Lab., Tenn. (USA)). 1974. 17p. Dep. NTIS $4.00.

From international symposium on leucocyte separation and transfusion; London, UK (9 Sep 1974).

An experimental design was constructed and tested to prove the principle of hematocrit measurement and control by conductivity determinations. The system was used to monitor the hematocrit of the blood in the packed red blood cell outlet line and to control the centrifuge rotor speed in order to establish and maintain this hematocrit at some preset value. A schematic is presented of circuitry used in the Aminco Celltrifuge used in the method. (CH)

13502 (CONF-740948-2) SENSITIVITY OF MOUSE EMBRYOS TO FREEZING AND THAWING. Leibo, S. P. (Oak Ridge National Lab., Tenn. (USA)). 1974. 39p. Dep. NTIS $5.00.

From UNESCO-ICLA-IRO workshop on basic aspects of freeze preservation of mouse strains; Bar Harbor, Maine, USA (16 Sep 1974).

Methods used for the long-term storage of frozen mouse embryos are reviewed. Variables discussed include the suspending medium and its concentration, cooling rate, minimum temperature of exposure, and warming rate. The methods resulted in the survival of embryos and their in vitro development to the blastocyst stage. (auth)

13503 (CONF-741023-5) INDIVIDUAL VARIATION OF TRACE METAL CONTENT IN FISH. Montgomery, J. R.; Kolehmainen, S. E.; Banus, M. D.; Bendien, B. J.; Donaldson, J. L.; Ramirez, J. A. (Puerto Rico Nuclear Center, Mayaguez). 1974. Contract AT(40-1)-1833. 19p. Dep. NTIS $4.00.

From 7th materials research symposium; Gaithersburg, Maryland, USA (7 Oct 1974).

The accuracy of trace element analyses for environmental samples is affected by the normal variation in biological samples, which makes it very difficult to adequately sample a population. The problem is illustrated by results of studies of iron, zinc, cadmium, lead, copper, and manganese concentrations in fish, using the thread herring as an example. The concentration of trace metals in different sizes of fish, different populations, and various tissues were compared to develop a criteria for obtaining adequate and representative sample sizes for trace element analyses. (CH)

13504 (CONF-741034-1) CARCINOGENIC N-NITROSO COMPOUNDS. Lijinsky, W.; Singer, G. M.; Taylor, H. W. (Oak Ridge National Lab., Tenn. (USA)). 1974. 4p. Dep. NTIS $4.00.

From 11th international cancer congress; Florence, Italy (20 Oct 1974).

The carcinogenic effects of N-nitroso compounds are reviewed. (CH)

13505 (CONF-741035-1) FLOATING, ROOTING, AND GROWTH OF RED MANGROVE (RHIZOPHORA MANGLE, L.) SEEDLINGS: EFFECT ON EXPANSION OF MANGROVES IN SOUTHWESTERN PUERTO RICO. Banus, M. D.; Kolehmainen, S. E. (Puerto Rico Nuclear Center, Mayaguez). 1974. 37p. Dep. NTIS $5.00.

From international symposium on biology and management of Mangroves; Honolulu, Hawaii, USA (7 Oct 1974).

The floating and rooting behavior of mangrove seedlings let the

seedlings leave the mangrove from which they fell and move to nearby shallow beds. The developing root systems are held by the accumulated algae and sediments and the seedlings become established. Most developing mangrove islands in South West Puerto Rico are on shoals protected by coral reefs from the ocean swells. (auth)

13506 (CONF-741035-2) DIVERSITY AND STABILITY IN A PUERTO RICAN RHIZOPHORA MANGLE (L) FOREST. Canoy, M. J. (Puerto Rico Nuclear Center, Mayaguez). 1974. 32p. Dep. NTIS $4.75.

From international symposium on biology and management of mangroves; Honolulu, Hawaii, USA (7 Oct 1974).

Data are summarized from a four-year study of the ecology of two mangrove forests on the south coast of Puerto Rico. (CH)

13507 (CONF-741076-1) PREPARATION AND USE OF HEPATITIS B SUBTYPING REAGENTS BY THE NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES. Nutter, J. E.; Gerin, J. L.; Taylor, P. E. (National Institutes of Health, Bethesda, Md. (USA)). [nd]. 8p. Dep. NTIS $4.00

From meeting of World Health Organization; Geneva, Switzerland (8 Oct 1974).

Methods used for the preparation of subtyping reagents for use in serologic techniques for the identification of Australia virus antigen in the blood of patients with hepatitis are described. (CH)

13508 (CONF-741201-1) HYDROGEN ION AS AN ATTRACTANT FOR SCHISTOSOMA MANSONI LARVAE. Brown, R. A. (Puerto Rico Nuclear Center, San Juan). 1974. 6p. Dep. NTIS $4.00.

From 6th Latin American Congress of microbiology; Caracas, Venezuela (1 Dec 1974).

The release from the host snail of a substance that attracts the Schistosoma mansoni parasite was investigated. Results showed that the release of the hydrogen ion serves as an attractant of both S. mansoni miracidia and cercarie over reasonably large distances. (CH)

13509 (COO-3120-11) IMAGE INTENSIFIER SYSTEM FOR RAPID RECORDING OF X-RAY DIFFRACTION MAXIMA FROM BIOLOGICAL MACROMOLECULES. Minor, T. C. (Princeton Univ., N. J. (USA)). Nov 1973. 195p. Dep. NTIS $12.75.

Thesis.

An image intensifier system is described for rapid recording of x-ray diffraction patterns from biological macromolecules. Tests on crystal data from hen egg white lysozyme are reported. (CH)

13510 (COO-3120-12) SINGLE CRYSTAL X-RAY STUDY OF LEUCYL-tRNA-AMINOACYL-LIGASE USING AN IMAGE INTENSIFIER-AIDED DETECTION SYSTEM. Milch, J. R. (Princeton Univ., N. J. (USA)). Sep 1974. 174p. Dep. NTIS $11.75.

Thesis.

A high speed x-ray recording system was used to study leucyl-tRNA-aminoacyl-ligase (protein) crystals from baker's yeast. The recording system used a rotation camera geometry; the x-rays were converted into light by a thin phosphor; this light was amplified by a high gain, magnetically focussed image intensifier, and the diffraction pattern was recorded on photographic film. (CH)

13511 (COO-3400-26) CALCIUM KINETICS IN COWS. Tenth Annual (Terminal) Progress Report, October 7, 1974. Ramberg, C. F. Jr. (Pennsylvania Univ., Kennett Square (USA). School of Veterinary Medicine). 1974. Contract AT(11-1)-3400. 4p. Dep. NTIS $4.00.

Results are reported from studies on Ca kinetics in cows in which ^{47}Ca and ^{45}Ca were used as tracers. Data on the gastrointestinal transport of Ca are included. (CH)

13512 (GEPP-127) LAND SPREADING OF INDUSTRIAL WASTE WATER AND THE EFFLUENT FROM A SECONDARY SEWAGE TREATMENT FACILITY. Ward, W. E.; Gray, D. V. (General Electric Co., St. Petersburg, Fla. (USA). Neutron Devices Dept.). 18 Nov 1974. Contract AT(29-2))656. 9p. Dep. NTIS $4.00.

A land spreading system is described that is used for the advanced treatment of liquid sanitary and industrial wastes. The system utilizes two retention lakes coupled through spray irrigation and subsurface drainage systems. The effluent from an industrial plant is discharged into a lake where it is aerated. When sufficient oxygen has been absorbed, the effluent is then spread over a ten-acre field by a spray irrigation system, where the vegetation removes nitrogen and phosphorus. Drainage pipes under the field collect the percolated effluent, which is pumped into the second retention lake. Samples taken from the second lake ascertain that the effluent meets state standards before being released to the adjoining surface water drainage pattern. Data is presented indicating the proficiency of land spreading in removing normal pollutants. (auth)

13513 (JUL-1095-NB) REACTION KINETIC STUDIES ON BOVINE RHODOPSIN, ROD OUTER SEGMENTS, AND 11-cis RETINAL (FLASH PHOTOMETRY, pH AND $[Ca^{++}]$ CHANGES, REGENERATION OF RHODOPSIN). Noell, G. N. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Neurobiologie). Aug 1974. 194p. (In German). Dep. NTIS (US Sales Only) $12.75.

Thesis. Submitted to Technische Hochschule, Aachen (West Germany).

Specific light-initiated reactions of the bovine visual pigment rhodopsin were studied by the methods of flash photolysis and spectrophotometry under several conditions. (auth)

13514 (LA-UR-74-1526) SEROLOGIC TESTING WITH ENZYME-LABELED ANTIBODIES (ELA). Saunders, G. C. (Los Alamos Scientific Lab., N. Mex. (USA)). [nd]. Contract W-7405-eng-36. 12p. (CONF-741077-1). Dep. NTIS $4.00.

From 17th annual meeting of American Association of Veterinary Laboratory of Diagnosticians; Roanoke, Virginia, USA (13 Oct 1974).

An indirect enzyme-labeled antibody (ELA) serological test system potentially suitable for the simultaneous screening of animals for antibodies to several diseases of domestic animals is described. (CH)

13515 (ORNL-TM-4578) STRIPED-BASS POPULATION MODEL AND COMPUTER PROGRAMS. Van Winkle, W.; Rust, B. W.; Goodyear, C. P.; Blum, S. R.; Thall, P. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 204p. Dep. NTIS $13.25.

A model to evaluate the long-term impact of changes in mortality in the youngest age class on a striped-bass population and fishery was prepared. This paper discusses the model formulation and computer programs including sample results. (CH)

13516 (ORNL-TM-4782) TECHNIQUE FOR THE PREPARATION OF SOIL MICROORGANISMS FOR SCANNING ELECTRON MICROSCOPY. Draggan, S. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 7p. Dep. NTIS $4.00.

The chromium procedure of metal coating improves the electron microscopic observation of soil microbes in situ especially when combined with specimen drying techniques employing critical point phenomena. Chromium improved sample reflectivity and provides for improved resolution of the irregular microhabitat surface, affording high quality electron images. (CH)

13517 (ORNL-tr-2868) COMPARATIVE STUDY OF THE ULTRASTRUCTURAL ORGANIZATION OF BLOOD PLATELETS IN LABORATORY ANIMALS. Gracheva, A. I.; Kurilets, E. S. Translated by Martha Gerrard from Tsitologiya; 16: No. 1, 11-17(1974). 13p. Dep. NTIS $4.00.

The ultrastructures of blood platelets of different species of animals were compared. The animals studied were Chinchilla rabbits, Wistar rats, golden hamsters, CBA mice, and guinea pigs. (CH)

13518 (ORNL-tr-2875) SERUM ESTERASES AND AFLATOXIN. Monjour, L.; Mariage, C. Translated by Maria Dolores Souto from Compt. Rend. Soc. Biol.; 163: 1261-1265 (1969). 6p. Dep. NTIS $4.00.

Serum esterases retain their enzyme properties after electrophoresis in agarose gel or after antigen-antibody precipitation during immunoelectrophoretic analysis. In order to study the esterase properties of the serums of rats ingesting a diet contaminated with 0.75 ppM of aflatoxin for 18 months (85% or more animals were carriers of hepatocarcinoma), polyacrylamide agarose, a substance having a high resolution power, was used. A new aspect of the effect of aflatoxin on protein synthesis is reported. (auth)

13519 (ORNL-UR-118) METHOD OF DELINEATION OF HOMOGENEOUS SOCIAL-ECOLOGICAL AREAS. Loebl, A. S.; Campbell, R. R. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 31p. Dep. NTIS $4.75.

A study was conducted in an effort to better understand the migration of people in two geo-political areas of the USA relevant to the socioeconomic structure of society. (CH)

13520 (RT/ING-(74)26) AUTOMATIC HANDLING TECHNIQUES OF INTRAUTERINE PRESSURE SIGNALS IN LABOR. Federico, A.; Papalia, B.; Taglienti, S. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 36p. (In Italian). Dep. NTIS (US Sales Only) $5.00.

Intrauterine pressure signals in spontaneous or drug affected

labors were studied, with the final purpose of automatic monitoring using computers. (auth)

13521 (UCRL-76046) SIMULATING THE DYNAMICS AND STRUCTURE OF POPULATIONS. Ewing, B.; Rauch, P.; Barbieri, J. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Sep 1974. 60p. (CONF-750101-1). Dep. NTIS $6.00.

From 3rd annual integrated pest management modellers conference; Berkeley, California, USA (Jan 1975).

A technique for simulating the dynamics of animal populations at the individual level is presented. By exploiting the inherent structure of the biological, mathematical, and computer systems, it was possible to create a simulator which effectively mimics the structure and dynamics of a biological population. (auth)

13522 (UCRL-76118) RATE OF DNA SYNTHESIS DURING S PHASE BY MAMMALIAN CELLS IN VITRO. Dean, P. N.; Anderson, E. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Oct 1974. 25p. (CONF-740954-2). Dep. NTIS $4.25.

From pulse-cytophotometry international symposium on automated cytofluorometry with special reference to methodology, cancer-screening and leukemia; Nijmegen, Netherlands (18 Sep 1974).

The rate of DNA synthesis during the S phase of the cell cycle of cultured mammalian cells was determined. Results were verified by measurements of ^{3}H-TdR incorporation. (CH)

13523 (UR-3490-601) HEALTH EFFECTS FROM LASERS: NEEDS FOR ADDITIONAL INVESTIGATION. Michaelson, S. M. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 12p. (CONF-741069-1). Dep. NTIS $4.00.

From working group on health effects from lasers; Dublin, Ireland (20 Oct 1974).

A critical review is presented of studies into the biological effects on man from exposure to laser energy. (CH)

13524 (UR-3490-612) EXTRACELLULAR CONTROL OF CELLULAR METABOLISM IN BONE. Neuman, W. F. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. Contract AT(11-1)-3490. 14p. (CONF-740972-2). Dep. NTIS $4.00.

From 2nd international colloquium on the extracellular control of cellular metabolism in bone; Santa Catalina Island, California, USA (18 Sep 1974).

Evidence is presented which indicates that glycolytic processes are intimately connected with the stabilization of a soluble mineral phase in bone and the regulation of calcium and phosphate levels in the medium surrounding the bone. Moreover, the control of these glycolytic processes are strongly dependent upon the conditions of the matrix surrounding the bone cells. Thus far, only three such parameters have been explored: phosphate levels, pH, and the integrity of the cellular membranes (endosteum and periosteum) surrounding the bone. (auth)

13525 (UR-3490-613) STUDY OF TRANSCELLULAR CALCIUM TRANSPORT IN EPITHELIAL TISSUE USING ELECTRON PARAMAGNETIC RESONANCE. Armbrecht, H. J. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 93p. Dep. NTIS $7.75.

Thesis.

Electron paramagnetic resonance (EPR) spectroscopy was used to study the biochemical environment of divalent cations in the Ca^{++} transport systems of two epithelial tissues, the chick chorioallantoic membrane and the small intestine of the rat. Mn^{++} was used as a paramagnetic probe for Ca^{++} and the EPR spectra of Mn^{++} in the tissue analyzed in an effort to learn more about the divalent cation transport mechanism of these tissues. (auth)

13526 (UR-3490-616) UPTAKE AND RETENTION OF INSUFFLATED TANTALUM BY LYMPH NODES. Kilpper, R. W.; Bianco, A.; Gibb, F. R.; Landman, S.; Morrow, P. E. (Rochester Univ., N. Y. (USA). School of Medicine and Dentistry). 1974. 20p. (CONF-740930-7). Dep. NTIS (U. S. Sales Only) $4.00.

From 14th Hanford biology symposium on radiation and the lymphatic system; Richland, Washington, USA (30 Sep 1974).

A radiographic technique for evaluating the lymph node uptake of radiographically-dense materials from the lungs of beagle dogs into which the material has been insufflated is presented. Using tantalum as the contrast agent, lymph nodes have become visible within two days post-exposure when the insufflation has resulted in radiographic alveolarization of some of the tantalum. Localization of the material within the nodes is observed in subsequent radiographs, as well as persistent retention after as much as a year. (auth)

13527 (UR-3490-621) CHEMICAL BASES UNDERLYING CALCIFICATION MECHANISMS. Neuman, W. F. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 9p. (CONF-740972-1). Dep. NTIS $4.00.

From 2nd international colloquium on the extracellular control of cellular metabolism in bone; Santa Catalina Island, California, USA (18 Sep 1974).

Chemical problems involved in the formation in bones of solid phase calcium phosphates, their stability and their dissolution. Proposed physiological mechanisms are reviewed in terms of the stabilities and metastabilities of various states of the aqueous: calcium: phosphate system. (auth)

13528 (UR-3490-623) DIFFERENTIAL EFFECTS OF MERCURIAL COMPOUNDS ON EXCITABLE TISSUES: CLINICAL IMPLICATIONS. Shamoo, A. E.; MacLennan, D. H.; Eldefrawi, M. E. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics; Toronto Univ., Ontario (Canada). Banting and Best Dept. of Medical Research; Cornell Univ., Ithaca, N. Y. (USA)). [nd]. 37p. (CONF-741122-1). Dep. NTIS $5.00.

From conference on intoxication due to alkyl mercury treated seed; Baghdad, India (9 Nov 1974).

Data are presented that demonstrate a molecular basis for the myopathy associated with mercurial compounds toxicity in animal tissues. (CH)

13529 ELECTRON MICROSCOPY AND CYTOCHEMISTRY. Proceedings of the Second International Symposium, Drienerlo, Netherlands, June 25-29, 1973. Wisse, E.; Daems, W. T.; Molenaar, I.; van Duijn, P. (eds.). Amsterdam; North-Holland Publishing Company (1974). 414p. (CONF-730679-; ISBN-0-7204-4125-0; ISBN-0-444-10605-7). $30.80.

From 2nd international symposium on electron microscopy and cytochemistry; Drienerlo, Netherlands (25 Jun 1973).

Fifty-four papers discuss various theories and techniques related to electron microscopy of biological materials, including enzyme cytochemistry, immunocytochemistry, x-ray microanalysis, staining reactions, autoradiography, and sample preparation. (CH)

Materials

13530 (AE-500) X-RAY ELASTIC CONSTANTS FOR CUBIC MATERIALS. Malen, K. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Oct 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The stress-strain relation to be used in x-ray stress measurements in anisotropic texture-free media is studied. The method for evaluation of appropriate elastic constants for a cubic medium is described. Some illustrative numerical examples were worked out including line broadening due to elastic anisotropy. The elastic stress and strain compatibility at grain boundaries is taken into account using Kröner's method. These elastic constants apply when no internal stresses due to plastic deformation are present. The case of reorientation of free interstitials in the stress field can be taken into account. (auth)

13531 (CEA-R-4545) NUCLEAR MAGNETIC RESONANCE AND STEREOCHEMISTRY OF ORGANOPHOSPHORUS COMPOUNDS: DITHIAPHOSPHOLANES AND DITHIAPHOSPHORINANES. Martin, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale). Nov 1974. 80p. (In French). Dep. NTIS (US Sales Only) $7.00.

Thesis. Submitted to Universite Scientifique et Medicale de Grenoble (France).

The full NMR spectrum analysis of two different kinds of heterocycles containing phosphorus and sulfur atoms (1,3,2-dithiaphospholanes and 1,3,2-dithiaphosphorinanes) with various groups attached to the phosphorus is reported in the present study. The results show that the ^{3}J(P,H) NMR coupling is quite independent upon the nature of the R group attached to the phosphorus. A change of sign has been observed in the ^{3}J(P,H) values. The absolute value of the ^{3}J(P,H) coupling is small, on the opposite of the ^{4}J(P,H) which may be as high as 7 Hz. The heterocycle conformation is discussed by examining the ^{3}J(H,H) values and using Karplus like relationship which is established for a $S-CH_2-CH_2-S$ fragment. A carbon edge envelope conformation with a 40° torsion angle around the C-C bond is proposed for the fine membered ring. A slightly distorted chair conformation is proposed for the six membered ring. (auth)

13532 (CONF-741057-1) DIRECT OBSERVATION OF THE SPIN-REORIENTATION TRANSITION AT Yb SITES IN $YbFeO_3$. Davidson, G. R.; Dunlap, B. D.; Eibschutz, M.; van Uitert, L. G. (Argonne National Lab., Ill. (USA)). 1974. Contract W-31-109-eng-38. 8p. Dep. NTIS $4.00.

From international symposium on the electronic structure of the actinides; Argonne, Illinois, USA (9 Oct 1974).

A direct observation of a 90° reorientation of Yb spins in $YbFeO_3$ by Mössbauer spectroscopy of single crystals is observed. Spectra are consistent with a continuous rotation of the Yb spins

in the region 6.6 K ≤ T ≤ 7.8 K with second-order phase transitions at the end points. The results agree with qualitative predictions by Horner and Varma and by Yamaguchi, but the quantitative predictions of Yamaguchi are found not to apply to $YbFeO_3$. (auth)

13533 (COO-1574-39) THERMAL CONDUCTIVITY OF SOLID ARGON. Christen, D. K. (Michigan State Univ., East Lansing (USA)). 1974. 151p. Dep. NTIS $10.75.

Thesis.

A cryogenic apparatus was designed and constructed to form large-grained, essentially free-standing samples of crystalline Argon. Subsequent in situ measurements of the thermal conductivity κ(T) were made by a linear flow method, covering a temperature range from the triple point, 83.8 K, to liquid He temperatures. The low temperature data were highly reproducible within a single run, while the high temperature data were reproducible among different runs. The data were of sufficient density to enable quantitative analysis in terms of present theory for heat transport in insulating solids at low temperatures. In particular, first principles calculations were performed of the anharmonic crystal force contribution to the thermal resistivity. These calculations are based upon best known interatomic potentials, including three-body corrections. They utilize a computer simulation of lattice wave interactions, as described by first order perturbation theory. The results of these calculations indicate that observed deviations from the T^{-1} temperature dependence expected of κ(T) at high temperatures can be quantitatively explained in terms of the effects of thermal expansion on the lattice vibrational frequencies. Furthermore, κ(T) is found to be a sensitive function of the exact functional form of the interatomic potential energy. At low temperatures, experimental data were compared with a relaxation time model. Indications show a lattice wave scattering mechanism which, at present, is not predicted by simple models of phonon scattering by lattice defects. (auth)

13534 (COO-1574-44) PROPERTIES OF RARE-GAS SOLIDS. (Michigan State Univ., East Lansing (USA)). [nd]. Contract AT(11-1)-1574. 15p. Dep. NTIS $4.00.

The properties of rare-gas solids and rare gases are considered. Theoretical and experimental calculations and experimental results of Kapitza resistance are compared. Results on thermal conductivity of solid argon in the range from 2 to 83.8°K were successful. The results were treated by current theories of heat transport in solids and phonon scattering in solids, the defect structure of crystals, interaction potential for Ar atoms, and the application of the phenomena to thermal conductivity are analyzed. The interaction of rare gases with physiological systems was studied. Techniques for measuring diffusion of Xe through membranes were improved. (MCW)

13535 (IAEA-R-818-F) RADIOSPECTROSCOPIC INVESTIGATION: THE ORDERING OF MAGNETICS CONTAINING THE IRON ISOTOPE ^{57}Fe. Final Report for the Period 1 November 1969-30 Jun 1973. Zalesskii, A. V. (International Atomic Energy Agency, Vienna (Austria)). Jul 1973. vp. (In Russian). INIS.

The ferromagnetic materials $\alpha-Fe_2O_3$, $BaFe_{12}O_{19}$, $BaFe_{18}O_{27}$, $DyFeO_3$, $YFeO_3$, and $ErFeO_3$ were studied by NMR spectrometry. Signals were observed that can be interpreted as coming from ^{57}Fe nuclei in the domain walls. The dependence of the NMR frequencies on the strength of an external magnetic field could be used to decide, by comparison with a simple theory, whether the resonating nuclei were located in the center or at the edge of the domain walls. The observed temperature dependence of the NMR frequencies agree with a simple theory. (tr-auth)

13536 (IFA-DNBR-13-1974) PAIR CORRELATION FUNCTIONS AND EFFECTIVE INTERACTION POTENTIAL IN LIQUID Sn BY INELASTIC NEUTRON SCATTERING. Rapeanu, S.; Padureanu, I.; Deciu, N. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

The space-temporal pair correlation functions G(r,t) were obtained using the results obtained from the cold neutron inelastic coherent scattering on liquid Sn for 0.5 $Å^{-1}$ ≤ K ≤ 2.2 $Å^{-1}$ at a T = 558°K. A theoretical behavior in the Gaussian approximation for F(k,t) in the case K > 2.2 $Å^{-1}$ was used. The radial distribution function of the atoms g(r) in the liquid Sn was obtained from $G_3(r,0)$. Starting from the g(r) development in the exponents of the particle number densities in the first approximation, an effective interaction potential was obtained. (auth)

13537 (LA-UR-74-1738) DETERMINATION OF BINDER DEGRADATION IN PLASTIC-BONDED EXPLOSIVES. Wewerka, E. M.; Loughran, E. D.; Williams, J. M. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 7p. (CONF-741204-4). Dep. NTIS $4.00.

From conference on compatibility of energetic materials with plastics and additives; Dover, New Jersey, USA (3 Dec 1974).

A description is given of molecular-size-distribution measurements made by gel-permeation chromatography used to detect degradation in the binder systems of plastic-bonded explosives. The procedures for sample preparation and chromatographic analysis are outlined. Several examples are given to illustrate the usefulness of this method for studying the stabilities of a variety of explosives systems. (auth)

13538 (LBL-2749) CRYOGENIC PROPERTIES OF Fe-Mn AND Fe-Mn-Cr ALLOYS. Schanfein, M. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 65p. Dep. NTIS $6.25.

Thesis.

When a bcc structure was produced, increasing Mn contents are detrimental to low temperature toughness. At Mn levels greater than 12%, the ductile-brittle transition temperature (DBTT) dropped rapidly with the (epsilon + γ) phases, but the yield strength also decreased. Increases in the yield strength were achieved without appreciable increase in the DBTT or decreases in the Charpy upper shelf energy and fracture toughness by greater Mn additions and by Cr additions. (DLC)

13539 (LBL-2788) REACTIVE SPUTTERING OF TITANIUM OXIDES: TARGET OXIDATION PHENOMENA AND THIN FILM CHARACTERIZATION. Geraghty, K. G. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 83p. Dep. NTIS $7.25.

Thesis.

The reactive sputtering of titanium was studied in a 25 millitorr Ar/O_2 rf plasma with oxygen mole fractions in the range 0 to 0.15, bias voltages in the range of 1 to 2 kV, and plasma power between 300 and 400 watts. Deposited titanium oxide films formed at various plasma oxygen compositions were characterized for density, deposition rate, electron diffraction characteristics, and uv, visible, and ir absorbance. The deposition rates of the amorphous films varied from 1 to 10 Å/sec, with a sharp transition occurring at a critical mole fraction of oxygen in the plasma, $y^* = 0.007$. The effect of target oxidation on deposition parameters was concurrently investigated, and transient and steady-state behavior of the reactive sputter process was correlated with film properties. y^* was determined to be the critical oxygen mole fraction in the plasma necessary for the initiation of target oxidation. At $y < y^*$, no oxide formed, and the sputtering rate reached a maximum at $y = 0.002$. At $y > y^*$, an oxide of finite thickness was formed, and the sputtering rate was essentially constant. Models for target oxidation are explored. The application of titanium oxide films for protective coatings is discussed. (auth)

13540 (SAND-74-0335) ADHESION OF EN-7 TO 91-LD AND EPIALL. Trodden, J. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

The bond strength of EN-7 polyurethane encapsulating material to 91-LD phenolic and Epiall-epoxy connector insert materials was evaluated before and after thermal shock and high moisture environments. Test results indicate that bond strengths are adequate to meet typical cable assembly requirements. However, the degree of adhesion is directly affected by the method of surface preparation prior to bonding. (auth)

13541 (SAND-74-5291) COMPATIBILITY TESTING TECHNIQUES FOR GASLESS PYROTECHNICS. Massis, T. M.; McCarthy, D. K.; Gould, D. J.; McLaughlin, B. D. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 26p. (CONF-741204-1). Dep. NTIS $4.50.

From conference on compatibility of energetic materials with plastics and additives; Dover, New Jersey, USA (3 Dec 1974).

Renewed interest in pyrotechnic compositions has caused a reexamination of compatibility test techniques. This has led to the application of several new methods to evaluate potential compatibility problems involving gasless pyrotechnic compositions. These two methods are scanning electron microscopy and electrochemical techniques (corrosion cell potentials and potentiokinetic sweep procedures). This paper describes the use of these techniques to evaluate compatibility between pyrotechnics and structural materials. (auth)

13542 (SAND-74-5292) COMPATIBILITY OF PBX-9404 AND DELRIN. Gould, D. J.; Massis, T. M.; Kjeldgaard, E. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 42p. (CONF-741204-2). Dep. NTIS $2.25.

From conference on compatibility of energetic materials with plastics and additives; Dover, New Jersey, USA (3 Dec 1974).

PBX-9404 (94% HMX, 3% nitrocellulose, 3% tris-β-chloroethyl phosphate) slowly decomposes with the evolution of gases such

as NO, NO_2, and N_2O from the nitrocellulose. It was determined that these gases diffused to a Delrin (polyoxymethylene) part and initiated stress corrosion and decomposition reactions. Experiments utilizing atmospheres containing small partial pressures of various oxides of nitrogen plus those evolved through accelerated aging of PBX-9404 in the presence of Delrin parts showed that these gases were responsible for starting an irreversible depolymerization reaction of the Delrin. (auth)

13543 (SAND-74-5322) AFMR VERSUS ORIENTATION IN WEAKLY FERROMAGNETIC $BaMnF_4$. Venturini, E. L.; Morgenthaler, F. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 10p. (CONF-741202-9). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The angular dependence of the antiferromagnetic resonance (AFMR) spectrum in barium manganese fluoride was studied at 4.2°K. The data reveal a splitting of one AFMR mode into two distinct modes as the applied static magnetic field is rotated away from the easy (b) axis in the (100) plane. No splitting is observed for magnetic fields in the (001) plane. The behavior was explained using a two-magnetic-sublattice model that includes a Dzyaloshinsky-Moriya (D-M) field along the crystal a axis. The field causes a canting of the otherwise antiparallel sublattices producing a weak ferromagnetic moment along the c axis. This canting may be masked in static magnetization measurements by the presence of domains with oppositely directed weak moments. The AFMR frequency differs in these two types of domains when the static magnetic field has a component along the c axis. The frequency splitting offers a new and sensitive measure of the strength of the D-M field. (auth)

13544 (SAND-74-5555) PRESSURE DEPENDENCE OF THE MAGNETIC ORDERING TEMPERATURES IN Cr–Fe ALLOYS. Edwards, L. R.; Fritz, I. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 14p. (CONF-741202-4). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The pressure dependences of the magnetic transition temperatures of Cr-2.5 and 2.8 at.% Fe single crystal alloys were determined by electrical resistance and ultrasonic measurements. The results show that the 1 bar triple point (P,I,C) in the temperature concentration plane occurs at a concentration of ~2.5 at.% Fe in contrast to the previously published value of 4 at.% Fe. The high pressure data showed an abrupt change in the pressure dependence of the I-C transition at 3.3 kbar, from which it is speculated that an additional magnetic phase exists. (auth)

13545 (SAND-74-5576) ULTRASONIC INVESTIGATION OF THE HIGH PRESSURE STRUCTURAL PHASE TRANSITION IN PARATELLURITE (TeO_2). Fritz, I. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 13p. (CONF-741123-1). Dep. NTIS $4.00.

From ultrasonics symposium; Milwaukee, Wisconsin, USA (11 Nov 1974).

Paratellurite was found to undergo a pressure-induced tetragonal to orthorhombic structural phase transition at about 8.9 kbar (at 23°C). The transition appears to be a second-order transition driven by a softening of the acoustic shear mode propagating along ⟨110⟩ and polarized along $\langle 1\bar{1}0 \rangle$. Experimental results indicate that there are no other soft modes for this material, that is, the transition is a second-order, pure strain transition of the type discussed theoretically by Anderson and Blount. High pressure ultrasonic measurements of several principal acoustic modes, including the soft mode, are presented along with a brief review of other high pressure measurements (light scattering, dielectric constant, neutron diffraction) on TeO_2. A simple phenomenological theory, based on a power series expansion of the crystalline strain energy density, was developed to describe the transition. The theory, which uses two order parameters, one primary and one secondary, successfully explains the important static and dynamic properties observed for the transition. (auth)

13546 (SAND-74-5819) STUDY OF STRUCTURAL PHASE TRANSITIONS AT HIGH PRESSURE: SOFT MODES IN FERROELECTRICS AND DIELECTRICS. Samara, G. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 14p. (CONF-741116-1). Dep. NTIS $4.00.

From 4th international conference on high pressure; Kyoto, Japan (25 Nov 1974).

There has been much recent progress in the understanding of structural phase transitions involving soft phonon modes. The conditions for lattice stability and the soft mode concept are discussed briefly. The decrease in the frequency of the soft mode as the transition is approached is caused by the cancellation between competing forces. Pressure can strongly modify the balance between these forces and thereby influence or even induce soft mode behavior. Indeed, high pressure studies have been very important —sometimes essential —to the understanding of the phenomena involved. Examples are given to illustrate a number of different facets of the general soft mode problem and the usefulness of pressure as a variable for investigating soft mode behavior. These examples include phase transitions in perovskites, hydrogen-bonded ferroelectrics of the KH_2PO_4-type, and paratellurite (TeO_2). The transitions involve either soft optic or soft acoustic modes. (auth)

13547 (UCRL-76077) ACOUSTIC EMISSION VS STRAIN AND STRAIN RATE: MEASUREMENT AND A DISLOCATION THEORY MODEL FOR A DISPERSION-STRENGTHENED ALUMINUM ALLOY. Hamstad, M. A.; Mukherjee, A. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Oct 1974. 33p. (CONF-741074-1). Dep. NTIS $4.75.

From fall conference of American Society for Nondestructive Testing; Detroit, Michigan, USA (21 Oct 1974).

The essential character of the continuous acoustic emission generated during a tensile test of 7075-T6 aluminum was studied. Measurement of this continuous acoustic emission by a true rms meter is discussed. The question of subtracting the background electronic noise from the acoustic emission signal is considered, as well as the question of the strain-rate sensitivity of continuous acoustic emission in this alloy. A theory describing the dependence of rms on strain and strain rate is derived using a dislocation theory model and the measurement characteristics of the rms meter. It is concluded that rms is proportional to the square root of the plastic strain rate, but that this half-power dependence is not a material constant. (auth)

Physics and Engineering

13548 (AWRE-O-36/74) SIMLA USERS' MANUAL. Yerkess, A. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Sep 1974. 130p. Dep. NTIS (US Sales Only) $9.50. UK £2.50.

A description is given of SIMLA (SIMple LAgrangian) the computer program that may be used to solve the Lagrangian equations of motion for one-dimensional unsteady compressible fluid flow in plane, cylindrical, or spherical geometry. The forms of equations of state that may be considered are also described. (auth)

13549 (AWRE-O-46/74) INFRASONIC AND SEISMIC WAVE RECORDS FROM THE FLIXBOROUGH AND ST BRIDGET EXPLOSIONS. Grover, F. H. (UKAEA Weapons Group, Aldermaston. Atomic Weapons Research Establishment). Oct 1974. 27p. Dep. NTIS (US Sales Only) $4.25. UK 50 pence.

Microbarometric and seismic perturbations recorded at distances in the range 245 to 350 km from two large explosions are described and compared. The explosions were at the NYPRO (UK) Chemical Works, Flixborough, Lincolnshire on 1 June 1974 and in a small ship, the St Bridget, in the English Channel on 14 February 1972. (auth)

13550 (CEA-R-4603) OPTICAL FIBER COMMUNICATIONS. Augier, G.; Kling, B.; Lafforgue, B. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 –Montrouge (France)). Nov 1974. 41p. (In French). Dep. NTIS (US Sales Only) $5.25.

The feasibility of optical communications with very low attenuation fibers is studied. Small size, electrical insulation, and electromagnetic pulse immunity are all excellent criteria in choosing this propagation medium. The components of such a link and the performances that can be reached with these optical systems by mathematical study using both impulse response and transfer function are shown. (tr-auth)

13551 (CONF-741202-3) DYNAMIC SUSCEPTIBILITY CALCULATIONS IN FERROMAGNETIC IRON. Cooke, J. F.; Lynn, J. W.; Davis, H. L. (Oak Ridge National Lab., Tenn. (USA)). 1974. 7p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Calculations of the low temperature dynamic susceptibility of ferromagnetic iron were carried out within the framework of an itinerant electron model. The formalism incorporates band and wave vector dependent matrix element effects and is essentially the same as that used in previous work on nickel. The spin wave dispersion curves calculated along the three principal symmetry directions are found to be in excellent agreement with neutron scattering experiments. In addition the calculations predict correctly the experimentally observed spin wave disappearance. These results indicate that low temperature spin waves in both nickel and iron can be adequately described in terms of an itinerant electron model without recourse to ad hoc assumptions about local moment behavior. (auth)

13552 (CONF-741202-5) MAGNETIC FORM FACTOR OF ELECTRONS IN 3d BANDS. Moon, R. M. (Oak Ridge National Lab., Tenn. (USA)). 1974. 9p. Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The formalism for calculating the spin density or magnetic form factor for tight-binding band electrons is considered in the case where nearest-neighbor over-lap is not negligible. The formalism leads to a description of the system in terms of a two-component form factor, one of which is identical to the atomic form factor and the other is related to the diffuse overlap density. Numerical calculations for Fe and Ni show that the net overlap density is opposite in direction to the atomic spin. Comparison with experiment is presented for the case of Fe. (auth)

13553 (COO-2203-3) CRITICAL SCATTERING OF LASER LIGHT BY THIN FLUID FILMS. Progress Report, February 1, 1974–January 31, 1975. Mockler, R.; O'Sullivan, W. (Colorado Univ., Boulder (USA). Dept. of Physics and Astrophysics). [nd]. Contract AT(11-1)-2203. 13p. Dep. NTIS $4.00.

The close-spaced Fabry-Perot interferometer was used to study the anomalous index of refraction of a critical binary mixture, and a theory was developed that enables the critical indices ν and η to be extracted from the experimental results. Efforts to suspend Brownian particles in a single component critical fluid (methyl fluoride) were proved successful, and initial light scattering studies of particle diffusion in a compressible critical fluid are planned. (auth)

13554 (COO-3161-27) DYNAMICS AND STATISTICAL MECHANICS OF A ONE-DIMENSIONAL MODEL HAMILTONIAN FOR STRUCTURAL PHASE TRANSITIONS. Krumhansl, J. A.; Schrieffer, J. R. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Oct 1974. 34p. Dep. NTIS $4.75.

The thermodynamic and dynamic properties of a one-dimensional model system whose displacement field Hamiltonian is strongly anharmonic and is representative of those used for displacive phase transitions are studied. Important solutions (domain walls) that cannot be represented effectively by the usual phonon perturbation expansions are studied by applying the classical equations of motion. The thermodynamic properties of this system can be calculated exactly by functional integral methods. No Hartree or decoupling approximations are made nor is a temperature dependence of the Hamiltonian introduced artificially. At low temperature, the thermodynamic behavior agrees with that found from a phenomenological model in which both phonons and domain walls are included as elementary excitations. It is shown that equal time correlation functions calculated by both functional integral and phenomenological methods agree, and that the dynamic correlation functions (calculated only phenomenologically) exhibit a spectrum with both phonon peaks and a central peak due to domain wall motion. (auth)

13555 (DP-MS-74-49) ^{129}I MOESSBAUER SPECTRA OF HgI_2 AND HIO_3. Stone, J. A.; Thompson, G. H. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1974. Contract AT(07-2)-1. 11p. (CONF-741209-1). Dep. NTIS $4.00.

From general meeting of the American Physical Society; Atlanta, Georgia, USA (5 Dec 1974).

The Moessbauer spectra for the compounds HgI_2 (mercuric iodide) and HIO_3 (iodic acid) are reported. The results may be compared with data from nuclear quadrupole resonance (NQR) spectroscopy, and provide structural information not available from NQR data. NQR measurements on $Hg^{127}I_2^{+4}$ and $H^{127}IO_3^{+5}$ were reported. Values of e^2qQ and η may be compared with the Mössbauer results by extrapolating to 4.2°K the NQR results obtained at higher temperatures. The agreement between the two methods is excellent. Although Mössbauer spectroscopy is not capable of the precision of NQR, it provides two additional pieces of information: the isomer shift and the sign of the quadrupole coupling constant. These are valuable in describing the electronic configurations of iodine in HgI_2 and HIO_3. (MCW)

13556 (GKSS-74/E/40) ADVANCED SEEDING PROCESS IN SALINE WATER CONVERSION. Froehner, K. R.; Panahandeh, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F.R. Germany)). 1974. 19p. Dep. NTIS (US Sales Only) $4.00.

The maximum process temperature in thermal saline water conversion plants, e.g. multi-stage flash evaporators, is at present limited by the production of calcium sulfate scale on heat transfer surfaces. The so-called seeding process, using calcium carbonate or sulfate as a seed, is effective in limiting calcium scale formation but suffers from several disadvantages. They can probably be overcome by the use of barium sulfate as a seed. Finely powdered barite has shown its effectivity as a seed in several pilot plant experiments. Based on these results, a technical feasibility study was elaborated. It is presented as a multi-stage flash evaporator plant working according to the barium sulfate seeding process (BSS). This process comprises recycling of the barium sulfate seed and, in addition, inherent diminution of the Ca concentration in the circulated brine. (auth)

13557 (IFA-SR-11-1974) PROGRAM FOR OPTIMAL COMPUTATION OF E.P.R. SPIN HAMILTONIAN PARAMETERS FOR IONS IN TETRAGONAL SYMMETRY. Stefanescu, A. S. (Institutul de Fizica Atomica, Bucharest (Romania)). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

The purpose of the program is to optimize the computation with respect to experimental error. The general form of the Hamiltonian with respect to the crystal axes is given. The environment of the computation is in an external magnetic field. (MCW)

13558 (INIS-mf-1516) INSTRUCTION MANUAL FOR THE F TO I CONVERTER. Bortoli, J. C.; Mudde, D. (Atomic Energy Board, Pelindaba, Pretoria (South Africa). Instrumentation Div.). Jan 1974. 24p. INIS.

This instrument is an interface unit converting an input frequency signal to a linear output current (4 to 20 mA standard). The input stage has been designed for low level input signals (8 mC p.t.p.) and temperature range of 5° to 25°C. Input and output are floating, giving a Common Mode Rejection Ratio (C. M. R. R.) of 85 db. approximately. Input circuitry is insulated up to 150^V AC or DC. The F to I converter is fitted with adjustments for F (zero) and span as requested by customers (see spec.). This instrument is delivered in a L. N. I. box (size 283 × 66 × 140 mm) for rack mounting and has main power tappings for 110, 125, 220, 250V/50 Hz. (INIS)

13559 (INT-53/PS) COMPARISON OF MAGNETIC STRUCTURES OF SPINELS WITH THE SUPEREXCHANGE THEORY. Luczynska-Loska, K. (Institute of Nuclear Physics and Techniques, Krakow (Poland)). 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

A compilation of tables of magnetic structures by neutron diffraction makes it possible to compare the experimental structures with the theoretical predictions. The comparison was made for cubic spinels of $MeFe_2O_4$, $MeCr_2O_4$, MeV_2O_4 type and normal spinels with only A-A interactions. (auth)

13560 (INT-55/I) SOME PROBLEMS OF THE OPTIMUM DESIGN AND EXPLOITATION OF HYDRAULIC CONVEYING INSTALLATIONS OF SOLID MATERIALS. Korbel, K. (Institute of Nuclear Physics and Techniques, Krakow (Poland)). 1974. 29p. (In Polish). Dep. NTIS (US Sales Only) $4.50.

Costs of hydraulic conveying of solid materials and conservation of energy expended for pumping of hydromixture are discussed. Under the assumption of the rational flow-velocity as the criterion of optimum performance of the hydrotransportation installation it was derived, on the basis of the empirical formula of Durand, the fundamental in the designing procedure relationship joining the delivery concentration of solids with the parameters of flowing medium and those of the pipeline. Attention is drawn to the effects determining the range of recommended delivery concentration of solids, such as the stabilization of the terminal velocity and the distribution of local concentration in the stream cross-section. The influence of the interphase slip on the accuracy of delivery concentration measurements in the case of installations provided with systems of automatic control of the solid phase content is also discussed. In conclusion, the necessity of undertaking routine measurements for the collection of experimental data necessary for the optimum design of hydraulic conveying installations is discussed. (auth)

13561 (JINR-13-6812) POLE ZERO COMPENSATION IN CASCADES WITH RL AND RLC DIFFERENTIATION. Ormandzhiev, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 12p. (In Russian). INIS.

The possibility of zero pole compensation in RL and RLC differentiating cascades is analyzed. Circuits to achieve this compensation are proposed. An analysis is made of the effect of the instability of the elements on the former parameters. The advantages of the RLC compensated cascades in comparison with analogous cascades on RC elements are shown. (tr-auth)

13562 (JINR-13-7166) UNIVIBRATOR ON INTEGRATED CIRCUITS WITH THE EMITTER COUPLING. Basiladze, S. G.; Tlachala, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1973. 17p. (In Russian). INIS.

A review is given of the variations in the construction of a fast integrated circuit univibrator with emitter coupling. Their classification according to the method of inclusion of the time-defining elements and by the method of triggering and the size of the dead time was discussed. The quantitative characteristics of the circuit were reported. (tr-auth)

13563 (JINR-13-7488) REFERENCE POWER SUPPLIES. Denisov, Yu. N.; Kalinichenko, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1973. 15p. (In Russian). INIS.

Reference power supplies of 1 mamp, 10 mamp, and 1 amp, designed with magnetic comparators, are described. The drift of the 1-amp power supply under laboratory conditions did not exceed 4×10^{-5} in eight hours of operation. The drift of the 1- and 10-mamp power supplies under the same conditions did not exceed 1×10^{-3}. (tr-auth)

13564 (JINR-P4-8104) STABILITY OF MANY-COMPONENT SYSTEMS. Kuz'min, S. K.; Temko, S. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Definite grounds are given for the general method of finding the minimizing vector-measure for many-component particle system which obeys the Liapunov criterion on stable equilibrium. (auth)

13565 (JINR-P11-7112) NATURAL EXTENSION OF AUTOMATA WITH A STABLE IMAGE IN A FREE SEMIGROUP. Voikov, G. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1973. 12p. (In Russian). INIS.

The relation between free semigroups and non-initial segments of incoming effect was examined in dynamic systems with discrete effects. In the majority of inputs of such systems an algebraic structure is introduced which guarantees the image stability of the natural extension of the machine. Some properties of this extension and the algebraic structure are indicated. (tr-auth)

13566 (LNF-74/20(R)) CALCULATION OF THE FORCE EXERCISED ON AN ALUMINUM PLATE MOVING UNIFORMLY IN A TRAVELING MAGNETIC FIELD MOVING SINUSOIDALLY IN THE DIRECTION OF MOTION. Moscati, F. G.; Sacerdoti, G.; Veca, M. G. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). 6 May 1974. 31p. (In Italian). Dep. NTIS (US Sales Only) $4.75.

In a study on magnetic suspensions for bodies in motion, the forces acting on a conducting support in uniform motion along the x axis and immersed in a traveling magnetic field moving sinusoidally in the direction of motion were calculated for the two-dimensional case. The pulling force, the maintenance force and the power dissipated by Joule effect in the moving plate are determined for various values of the parameters characterizing the structure, both geometric and electric. The numerical results are tabulated. (JSR)

13567 (NASA-SP-5907(03)) ELECTRONIC TEST INSTRUMENTATION AND TECHNIQUES: A COMPILATION. (National Aeronautics and Space Administration, Washington, D. C. (USA)). [nd]. 28p. NTIS $1.00.

The National Aeronautics and Space Administration and Atomic Energy Commission have established a Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace and nuclear communities. This document is one of a series intended to furnish such information. The Compilation is divided into three sections that reflect the more important uses of such test equipment and techniques, as they have been employed in the space research and development programs, both in-house and by NASA and AEC contractors. The first section introduces a group of modifications and adaptations that have been found useful to either enlarge the scope of usefulness or divert from their basic uses to alternate applications, a selection of available devices and established techniques. Section two presents items that have been of benefit to professional personnel in the enlargement and improvement of quality control capabilities. The third section covers a number of items that have simplified or made more accurate the very important function of calibration, upon which much depends when measurements or analyses are involved. (WHK)

13568 (NASA-SP-5916(03)) ELECTRICAL HAND TOOLS AND TECHNIQUES. A Compilation. (National Aeronautics and Space Administration, Washington, D. C. (USA)). [nd]. 25p. NTIS $1.00.

A collection of innovations developed by NASA, AEC, and their contractors concerning tools, adaptors, fixtures, and shop hints for use in assembling, installing, and servicing electrical components and equipment is compiled. Section One covers a variety of tools for assembly and installation procedures and Section Two discusses a number of devices useful in service and maintenance techniques such as straightening, cleaning, and replacing electrical components. The last section contains shop hints for solving minor problems. (MCW)

13569 (NVO-289-12) RESPONSE OF SMALL ISLANDS TO LONG WAVES. Brandsma, M.; Divoky, D.; Hwang, L. S. (Tetra Tech, Inc., Pasadena, Calif. (USA)). Aug 1974. Contract AT(26-1)-289. 95p. Dep. NTIS $4.00

A numerical method for predicting the response of small islands to long period water waves is presented. The method consists of an explicit finite difference solution to the linearized long wave equations together with an open water boundary condition that accounts for both incident and reflected waves. The limitations of the theory are discussed. Computed results are presented for three Pacific Islands: Johnston, Wake, and Marcus. Response curves are given as functions of frequency and angle of incidence for use in interpretation of nearshore tsunami records. (MCW)

13570 (SAND-74-0283) EXPLORATORY DEVELOPMENT OF A TELEMETRY UP-LINK FOR AN EARTH PENETRATOR. Caffey, T. W. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 53p. Dep. NTIS $5.75.

The theory, design, development, and field testing of a telemetry-quality communications link with which signals may be sent to the surface of the earth from a penetrator buried as much as 50 meters in the earth are described. A bit rate of 10^3 bits per second with an error rate of less than one error in 10^5 bits was finally achieved from a depth of 52 meters using 10 watts in a PCM/FM system operating at 10.5 kHz. (auth)

13571 (SAND-74-0305) CALIBRATION WIND TUNNEL FOR THE DEVELOPMENT OF HIGH-SPEED FLOW FIELD DIAGNOSTIC TECHNIQUES. Peterson, C. W.; Powers, C. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 32p. Dep. NTIS $4.75.

A small calibration wind tunnel was constructed as a test bed for developing new wind tunnel instrumentation and calibrating existing probes in high-speed flows. Three open-jet nozzles with nominal Mach numbers of 2.5, 5.5, and 7.5 are operated over an exceptionally wide range of free-stream pressures and temperatures. Pitot probes were calibrated for viscous and rarefaction effects in the flows produced by these nozzles. The continuous operation and flexible design of the calibration wind tunnel make it suitable as a facility for basic research studies in fluid mechanics. (auth)

13572 (SAND-74-0361) ANALYSIS OF THE LATERAL MOTION OF AN UNBALANCED PROJECTILE IN A RIGID GUN TUBE. Perdreauville, F. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1974. Contract AT(29-1)-789. 16p. Dep. NTIS $4.00.

An extension to an analysis that addresses the lateral motion of a dynamically balanced projectile in a straight, rigid gun tube is presented. The report contains modified equations of motion that allow for more convenient representation of spin rate as a function of rifling torque. The equations of motion also contain all products of inertia, moments of inertia, and center of mass offset from projectile geometric spin axis. (auth)

13573 (SAND-74-5258) COMPARISON OF THE MAGNETIC PROPERTIES OF THE HUBBARD HAMILTONIAN IN THE WEAK CORRELATION LIMIT TO THE HFA. Bartel, L. C.; Jarrett, H. S. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 6p. (CONF-741202-1). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Resonance broadening is included along with spin-disorder scattering to study the magnetic properties of the Hubbard-Hamiltonian in the weak correlation limit. The calculated susceptibility is compared to the exchange enhanced Hartree-Fock approximation (HFA) susceptibility, and limits are set on the applicability of the HFA. For a semicircular density of states, HFA appears to be applicable for $I/\Delta<0.5$ and a half-filled band, but for low electron (or hole) densities the range of applicability in I/Δ decreases. (auth)

13574 (SAND-74-5313) HIGH-TEMPERATURE SERIES STUDIES OF ISING-LIKE WILSON MODELS IN THREE DIMENSIONS. Camp, W. J.; Van Dyke, J. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 6p. (CONF-741202-8). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The susceptibility of continuous-spin Landau-Wilson models on the fcc lattice using exact series expansions through 10th order in the inverse temperature is studied. Both order-disorder (double-well) and displacive (single-well) models were considered. The exponent γ of the dominant singularity is found to be 1.25 for both types of model. The confluent singularity arising from corrections to scaling is found to have the universal value $\delta = 0.5$. The crossover from Gaussian to Ising behavior is discussed as a function of the quartic coupling constant, and a crossover exponent $\phi = 1$ in all dimensions is found. (auth)

13575 (SAND-74-5384) CONSEQUENCES OF EXCHANGE IN LOW DIMENSIONAL COMPOUNDS: HIGH TEMPERATURE SPIN DYNAMICS AS SAMPLED BY MAGNETIC RESONANCE. Richards, P. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 23p. (CONF-740961-1). Dep. NTIS $4.25.

From proceedings on low dimensional physics; Starnberg, F.R. Germany (3 Sep 1974).

It is shown that the consequences of exchange on the spin dynamics are to give rise to a coupled motion of the electron spins that is believed to be diffusive for long times in the paramagnetic state. This leads to an exchange narrowing of the ESR line in all dimensions, but the narrowing is less estreme in low dimensions, and there are anomalous features of the linewidth and line shape in 1d and 2d systems compared with 3d. The nature of these effects and some approximate formulae that hopefully will serve as useful guides and replacements for the conventional 3d formula $\Delta H \propto \langle \Delta\omega^2 \rangle / \omega_e$ which simply is not applicable to low-dimensions, are presented. (MCW)

13576 (SAND-74-5520). LASERS AND LED's FOR OPTICAL FIBER TRANSMISSION. Galt, J. K. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. Contract . 5p. (CONF-750102-1). Dep. NTIS $4.00.

From topical meeting on optical fiber transmission: Williamsburg, Virginia, USA (7 Jan 1975).

The requirements for sources to be used in optical fiber transmissions systems are outlined. Laser and LED sources are then discussed in relation to those requirements. (auth)

13577 (SAND-74-5566) BRITTLE FRACTURE CONSIDERATIONS OF TWO EXTERNAL NOTCHES UNDER COMBINED LOADING. Kipp, M. E.; Sih, G. C. (Sandia Labs., Albuquerque, N. Mex. (USA); Lehigh Univ., Bethlehem, Pa. (USA). Inst. of Fracture and Solid Mechanics). [nd]. 21p. (CONF-741128-1). Dep. NTIS $4.25

From Society of Engineering Science, Inc.; Durham, North Carolina, USA (11 Nov 1974).

The interaction behavior of two external notches, modeled by plane hyperbolas, is analyzed using the strain energy failure criterion. It is shown that the pure shear and normal loadings may be combined to the case of inclined or off-axis loading of this double-notch geometry. The crack trajectory emanating from the notch surface is hypothesized to follow the path of the minimum values of the strain energy density function. The failure loads are shown to vary with the angle between the inclined load and the major axis of the notch. The variations depend on the aspect ratios of the notches. A composite plot of the crack trajectories for different loading angles is presented. The double-notch geometry is such that only local trajectory information can be gleaned from the initial state. Numerical results of failure load, fracture angle, and other properties are given for notches with different degrees of bluntness. (auth)

13578 (SAND-74-5575) MEASUREMENT OF INTER-CHAIN DIFFUSION IN A QUASI-ONE DIMENSIONAL HEISENBERG MAGNET. Richards, P. M.; Hughes, R. C. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 14p. (CONF-741202-6). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The characteristic time t_c for spin polarization to transfer between magnetically inequivalent chains was measured in the quasi one-dimensional salt dichlorobis(pyridine)copper(II) ($CuCl_2 \cdot 2NC_5H_5$). The method utilizes the large difference in ESR linewidths between directions of applied field where the chains appear to be inequivalent and symmetry directions where they are equivalent. Data at 23 GHz are presented between 300°K and 4°K and interpreted in terms of temperature variation of the intrachain diffusion coefficient for $T \gtrsim 10$°K and the effect of antiferromagnetic correlations at lower temperatures. The time t_c does not appear to be influenced by spin lattice relaxation, whereas the linewidth along symmetry directions does appear to be so affected. (auth)

13579 (SAND-74-5579) PRESSURE DEPENDENCE OF THE RARE EARTH KNIGHT SHIFT IN THE SINGLET GROUND STATE SYSTEMS PrP AND TmP. Weaver, H. T.; Schirber, J. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 12p. (CONF-741202-10). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

The pressure dependence was measured of the Knight shift (K) for ^{141}Pr in PrP and ^{169}Tm in TmP at 4°K and find d ln K/dP = 0.83% and 0.48%/kbar, respectively. Both compounds are paramagnetic but exhibit a temperature independent (Van Vleck) susceptibility near T = 0 due to the crystal field induced singlet electronic ground state. The rare earth Knight shift provides a direct measurement of the susceptibility (χ_{vv}), from which the crystal field splitting (Δ) may be determined, i.e., $\chi_{vv} \propto \Delta^{-1}$. Thus, the result of d ln K/dP > 0 is in qualitative disagreement with the usually successful effective point charge model. Such a model implies that Δ varies as some inverse power of the lattice constant and, consequently, that the pressure derivative (d ln K/dP) is negative. Anomalous conduction electron-nuclear coupling effects were checked by measuring the pressure dependence of the ^{31}P Knight shift in PrP. However, the observed small d ln K/dP (≈ 0.06%/kbar) excludes this possibility and probably results from the same susceptibility change that is responsible for the rare earth resonance behavior. (auth)

13580 (SAND-74-5603) SPECTRAL WEIGHT OF LOW-LYING EXCITATIONS IN THE ONE-DIMENSIONAL SPIN 1/2 HEISENBERG ANTIFERROMAGNET. Bonner, J. C.; Sutherland, B.; Richards, P. M. (Utah Univ., Salt Lake City (USA); Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 7p. (CONF-741202-2). Dep. NTIS $4.00.

From 20th annual conference on magnetism and magnetic materials; San Francisco, California, USA (3 Dec 1974).

Numerical calculations on a spin $^1/_2$ one-dimensional (1D) Heisenberg antiferromagnet for N = 8 spins, both for the states and their spectral weights, were examined. The work is of interest because of the recent neutron scattering experiments in $CuCl_2 \cdot 2NC_5D_5$ that show the spectral weight to be concentrated at the des Cloizeaux and Pearson (dCP) spin wave frequencies. The states form a two-parameter continuum between the dCP value $E_1(k) = \pi|J|\ |\sin k|$ and the upper limit $E_2(k) = 2\pi|J|\ |\sin(k/2)|$. Though most of the spectral weight is at the dCP frequency for N = 8, about 10% of it is found near E_2 for $k = \pi$. There is no numerical evidence for the existence of singlet bound states as predicted by Ovchinnikov. (auth)

13581 (SAND-74-8213) GAS-TRANSFER ANALYSIS SECTION C: RECEIVER CONDITIONS AND UNCHOKE TIMES. Chenoweth, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 24p. Dep. NTIS $4.25.

The theoretical analysis of gas-transfer develops ideal-gas expressions for receiver-gas state variables valid for both of the limiting cases, adiabatic or isothermal reservoirs. These expressions hold regardless of whether the transfer flow is choked or unchoked. However, a complete time-dependent solution is possible only if separate choked and unchoked solutions are derived. The time of unchoking is therefore derived for both adiabatic and isothermal reservoirs with unity and non-unity loss coefficient, λ. Furthermore, expressions for λ in the special case of constant-area pipe flow are presented and discussed. (auth)

13582 (SAND-74-8214) GAS-TRANSFER ANALYSIS SECTION D: UNCHOKED CHARGING SOLUTIONS. Chenoweth, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 21p. Dep. NTIS $4.25.

The theoretical analysis of gas-transfer derives the exact subsonic charging solutions (infinite supply volume) in terms of the minimum flow area "Crocco number" for both adiabatic and isothermal reservoirs. The solutions are valid for an ideal gas and unity loss coefficient but arbitrary time-dependent product of discharge coefficient and minimum flow area, C_dA_e. Extensive results are presented for constant C_dA_e where it is shown that all possible charging solutions can be presented in non-dimensional form with only a few graphs. It is shown that simple expressions for the time of pressure equilibrium exist in terms of a reference time scale, the ratio of specific heats, and the initial receiver to supply pressure ratio. The choked flow solutions from Section B are coupled to these results and are included for completeness. (auth)

13583 (SAND-74-8216) GAS-TRANSFER ANALYSIS, SECTION F: APPROXIMATE UNCHOKED SOLUTIONS FOR ARBITRARY V_∞/V_0. Chenoweth, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 43p. Dep. NTIS $5.25.

The approximate subsonic gas-transfer solutions, valid for arbitrary receiver to supply volume ratio, in terms of the minimum flow area "Crocco number" for both adiabatic and isothermal reservoirs are derived. The solutions hold for an ideal gas and unity loss coefficient, but arbitrary time-dependent product of discharge coefficient and minimum flow area, C_dA_e. Illustrative results are presented for constant C_dA_e and various values of the volume ratio (receiver to supply). It is shown that for each value of the volume ratio simple expressions for the time of pressure equilibrium exist in terms of a reference time scale, the ratio of specific heats, and the initial receiver to supply pressure ratio. The results of Section D for charging are recovered exactly from these solutions but those of Section E for discharging are only approximately recovered, although the approximation is very good. The choked flow solutions from Section B are coupled to these results and are included for completeness. (auth)

13584 (SAND-74-8502) FABRICATING CLOSED CHANNELS BY ELECTROFORMING. Johnson, H. R.; Dini, J. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 34p. (CONF-741206-1). Dep. NTIS $4.75.

From Electroforming Symposium; Atlanta, Georgia, USA (9 Dec 1974).

Three techniques for producing closed channels by electroplating are described; they are plating in channels, the diffusion technique, and plating across open channels. These techniques permit closed channels of different sizes to be created; openings as small as 750 μm^2 (1.2×10^{-6} $in.^2$) (equivalent to the area of a wire 0.0013 inch in diameter) were fabricated with the plating-in-channels method. Where large channels are required, the plating-across-open-channels technique can be used. (auth)

13585 (SAND-74-8662) METHOD FOR PREDICTING NATURAL CONVECTION IN CLOSED VESSELS. Kee, R. J.; McKillop, A. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 12p. (CONF-741001-34). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

A numerical technique is presented which predicts the transient, two-dimensional, laminar natural convection within closed vessels. The finite difference analogs of the Navier-Stokes and the thermal energy equations are solved in an Eulerian stream function-vorticity framework. The parabolic transport equations (vorticity and thermal energy) are solved by a method, which is called a hybrid, that combines desirable features from both explicit and Alternating Direction Implicit methods. By treating the advection terms explicitly and the diffusion terms as in an ADI scheme, a very efficient solution algorithm can be employed. Conservative windward differencing, which accounts for the direction of the fluid motion, is used for the nonlinear advection terms. The elliptic stream function equation is solved by an iterative ADI method. (auth)

13586 (UCID-16065) INSTRUMENTING THE LAPQ-1 AIRBORNE CLOUD-MAPPING RADAR FOR UTILIZATION ON OPERATION DIAL TRAIN. Mortensen, W. K.; Border, E. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1972. 36p. Dep. NTIS $5.00.

The implementation of the LAPQ-1 Radar system on Operation Dial Train for the purpose of collecting radar cross-section data on certain radar targets is described. The special instrumentation required, the modifications to the radar required, and the problems encountered in preparing to operate the radar aboard ship are discussed. (MCW)

13587 (UCID-16606) MODEL OF SM-2 (ER). Brown, M. E.; Herman, P. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Oct 1974. Contract W-7405-eng-48. 28p. Dep. NTIS $4.50.

The model is symmetric about the longitudinal axis of the missile. It was necessary to homogenize various missile components over ficticious volumes, particularly the dorsal fins and control surfaces of the missile. (MCW)

13588 (UCID-16618) FEASIBILITY OF ELECTROCHEMICAL MACHINING FACILITY AT LLL. A Committee Report. Randall, W. L. (comp.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1974. Contract W-7405-eng-48. 5p. Dep. NTIS $4.00.

Electrochemical machining is most suitable for applications where: large production quantities are required in difficult to machine shape or material that is suitable for ECM and the material hardness and/or surface requirements make the job impossible or at least very unattractive to do by any method except ECM. Problems at LLL have not required these specifications, but a possibility may arise in the production of turbine blades or buckets for geothermal applications. An ECM facility would require one million dollars for equipment. (MCW)

13589 (UCID-16660) RQGPAK: A PACKAGE OF FORTRAN SUBPROGRAMS TO COMPUTE MACROSCOPIC PROPERTIES OF RELATIVISTIC QUANTUM GASES. Vajk, J. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1974. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

The theory of relativistic gases of particles obeying Bose–Einstein, Fermi–Dirac, or Maxwell–Boltzmann statistics is reviewed briefly. A package of FORTRAN subprograms which compute the macroscopic thermodynamic properties of such gases for arbitrary nonvanishing densities and temperatures (provided the independent particle model is applicable) is then described. These are especially useful for astrophysical problems in which particle-antiparticle pairs must be correctly treated. (auth)

13590 (UCRL-76034) INFLUENCE OF AIR-BORNE NOISE ON THE STRUCTURES OF PRECISION MACHINE TOOLS AND GAGES. Bryan, J.; Brooks, H.; Lamb, J.; Willett, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Sep 1974. 19p. (CONF-741108-1). Dep. NTIS $4.00.

From Society of Manufacturing Engineers conference; San Francisco, California, USA (19 Nov 1974).

Results of tests on the sensitivity of a diamond turning machine and a Talystep surface finish analyzer to acoustic vibration are presented. Resonant peaks of vibration greater than 4 μin. peak-to-valley were observed between the turning machine tool post and spindle at moderate sound levels (i.e., the amount of noise in a fairly quiet machine shop.) (auth)

13591 (UCRL-76092) ULTRA-FAST STREAK CAMERA FOR OPTICAL PULSE MEASUREMENTS. Houghton, J. W.; Thomas, S. W.; Coleman, L. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Oct 1974. 9p. (CONF-741054-1). Dep. NTIS $4.00.

From international instrumentation automation conference; New York, New York, USA (28 Oct 1974).

The requirements and techniques for time resolved subnanosecond diagnostics of laser pulses are reviewed. The advantages and limitations of applying image converter streak cameras to the problem of optical pulse diagnostics are discussed. The design and operation of a unique 10-ps resolution streak camera, and examples of its application to optical pulse measurement are presented. Also included are comments on the development of streak cameras with extended capabilities. (auth)

13592 (UCRL-76093) DESIGN OF A HYDRAULIC TOOL HEIGHT ADJUSTER. Donaldson, R.; Bryan, J.; Clouser, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1974. 11p. (CONF-741108-2). Dep. NTIS $4.00.

From Society of Manufacturing Engineers conference; San Francisco, California, USA (19 Nov 1974).

The hydraulic tool height adjuster provides a means for fine adjustment of tool height through a total range of 0.003" with one microinch sensitivity. Stiffness and freedom from creep are prime considerations. The system consists of a one convolution, 3-inch diameter bellows of $\frac{3}{8}$" thick 4340 steel, and a $\frac{1}{4}$" diameter, $\frac{3}{4}$" travel piston actuated by a fine threaded screw. (auth)

13593 (Y-DJ-15063) APPLICATIONS OF MAINTENANCE THEORY. Holland, C. W. (Oak Ridge Y-12 Plant, Tenn. (USA)). [nd]. Contract W-7405-eng-26. 11p. (CONF-741080-1). Dep. NTIS $4.00.

From annual meeting of institute of management science; Miami, Florida, USA (30 Oct 1974).

A practical procedure is described for applying existing theory to obtain "approximate optimum" preventive maintenance policies for homogeneous pieces of equipment. In addition, the problem of detecting changes in time-to-failure distributions, the relation of these distributions to the life cycles of the equipment, and common mistakes that can result in improper preventive maintenance policies are discussed. Examples are discussed. (auth)

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